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TENTH ANNUAL REPORT

OF THE

BOARD OF HEALTH

OF THE

STATE OF NEW JERSEY,

AND REPORT OF THE

BUREAU OF VITAL STATISTICS.

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REPORT OF THE SECRETARY OF THE BOARD.

To His Excellency Leon Abbett:

GOVERNOR—I have the honor, on behalf of the State Board of Health, to present to your Excellency and through you to the Legislature of the State, this its tenth report.

During the decade which has now nearly passed since this Board was established, the progress of sanitary science and art has been among the most important and notable achievements of the age.

The practitioners of the healing art have not only recognized it as essential to their calling, but have interwoven many of its principles not less with the treatment of disease than with its prevention.

Its outlook is even in advance of this, so that Prof. Robert Koch, in his recent opening address before the University of Berlin, said: "Hithertofore, gentlemen, you have been taught how to endeavor to cure disease; henceforth you will be taught how to succeed in preventing disease." While this does not mean that disease will ever cease from the earth, it does mean that the causes of very many diseases are within the range and the duty of our control. It does mean that the occassional infection need not become epidemic, and that the fatality of individual cases can be greatly diminished.

This interest has not been confined to any one calling. We no longer need point to Kingsly and Farrar among the clergy, to Lord Derby and Disraeli among statesmen, to Rawlinson and Denton among engineers, to Angus Smith and Frankland among chemists, to Quételet and Farr among statisticians, as those who in their respective callings could be singled out for their perception of the necessity of a consideration of this subject.

Every science, every art and almost every calling have come to express their interest and to contribute from their stores to its essential progress.

It is no longer patronized as a philanthropy, but pursued as a political economy. Labor has no more earnest plea for its defense

and life, no more inalienable right for its preservation. However deficient the practice of the art of prevention may be, the sentiment of society responds to the recent declaration of a distinguished civilian: "In the world there is no value but human life, and human life has the greatest value when healthy and moral." To the appreciation, conservation and preservation of this life, patriotism and citizenship may well turn their energies.

At the September meeting of the Sanitary Congress of Great Britain, Sir Spencer Wells spoke thus of the national and economic view of sanitary progress:

"When we speak of the prolongation of life, we think chiefly of the advantage to individuals, their better health and their augmented power of enjoyment. This is a great deal. But it means more for the State. It may sound well to declaim against the money view of the subject as low and sordid, but it is not to be overlooked when we are apportioning merit for work done. A donation to the community of two or three millions would be looked upon as an extravagance. But what is the fact? During the forty-nine years that registration has been in force, and sanitary reforms have advanced with its annually increased information, about eight millions of people have been added to the population of the United Kingdom. We may fairly credit our reforms with a large proportion of this increase in numbers, and consequently of their money value. The result on human happiness is not a matter of calculation, but a future industrial census will show in a very definite shape the effect of sanitation in raising the economic value of the population. We cannot be far wrong if we put the average duration of human life in Great Britain half a century ago at about thirty years; now, according to the healthy life-table, it is forty-nine years. The population, in less than fifty years, increased, as I have said, by some eight millions. Each individual of these millions was worth to the State, as is calculated, about £150. Say that only two millions out of the eight millions of increased numbers were the fruit of sanitary and medical work, their economical value was at least £300,000,000, and that a clear gain. To this we must add that the productive powers of the population depend on labor, and that labor depends upon health. Let sickness come, men are disabled, their labor ceases, and the produce of labor is lost. Formerly it was calculated that a twenty-third part of the population was constantly sick, and the products of all that labor for the time necessarily withdrawn. A great deal of this sickness has been altogether prevented, and the duration of that which comes in spite of sanitation is lessened. Happily did Richardson give form and expression to the proverb, 'National health is national wealth!' and well may Froude follow with his paraphrase, 'The *Commonwealth* is the *common health*,

the common wellness,' and add, 'No nation can prosper long which attaches to its *wealth* any other meaning.'"

From an efficient care of the public health many practical results have already resulted. In those countries where there has been the greatest perfection of service, health legislation and health administration have commanded the common approval of the people. Statistics like those of England show a notable and sustained decrease of death-rate through the three last decades, especially in the communicable diseases. In our own State, so far as the record has been safe for deduction, the general results are encouraging. Especially are they so in those localities in which the sanitary administration has been most thorough and progressive. Even if there had been no diminution of the death-rate there is some occasion for encouragement. As the struggle for existence is constantly becoming more severe; the people more rapidly crowding from the rural districts into compact cities; the proportion of indoor industries multiplying, the stress and the strain of conditions tends greatly to increase the invalidity and mortality of the people. Devotion not only to the theories but to the exact business-like details of, and enforcement of, sanitation has become a part of the law of self-preservation and of preparation for national perpetuity. If we can only succeed in preserving the former average of health and life we will at least have provided some barriers against that devitalization which tend to consign so many to an invalid dependence or an untimely death.

The returns of mortality for the year ending July 1st, 1886, show and improved condition of the public health. The detailed tables which accompany this report, as a part of the report on vital statistics, will enable health officers to compare the various localities as also to note the comparitive prevalence of special diseases. As rural districts are compared with cities, and as different cities or different parts of the same city are compared with each other, it is found that the prevalence of sickness and the occurrence of deaths at many of the age periods at which they occur might easily have been prevented. Every increase in accuracy of observation and in the application of numerical tests still more substantiates the relation which is claimed to exist between insanitary conditions and disease.

It is not unfrequently that the sanitarian of the present day is met with the recital of cases or instances where persons have lived for years amid filth or engaged in occupations involving constant exposure

to bad air or to the necessity of using foul water, and yet have maintained a good degree of health. The careless observer makes a hasty generalization and concludes that after all filth is not so bad as some think, and that the relations between sickness and foul air, foul water and foul food is partly imaginary. It is no doubt true that the resistful power of some persons is far greater than that of others, and that a degree of toleration is often established which renders some persons comparatively unsusceptible after acclimation. But the careful observer or inquirer does not fail to remember that such an argument is inconclusive unless it is shown that the exposure or occupation has also agreed with the great majority of those who have engaged in it, and that the life history of at least a thousand persons must be followed out if we would know the actual law of results. The natural vigor of the person, the modes of inurement, the habit of adjustment to the work, the length of working years, the effect upon offspring and various other items must be thought of, in making up the decision as to the general effects. There can be found cutlers, potters, operatives in cotton and wool who have lived to be old, but this does not prove the sanitary value or harmlessness of the dust arising from these industries. Often the men themselves will tell you that they suffer no serious harm. But whenever systematic investigation has been made the life and sickness tables have in the aggregate told the serious results.

"Only very strong, or more accurately insusceptible, persons could engage in such avocations with impunity, and having been habitually exposed to the effluvia for some time, they would naturally become, as it were, inured to the contact with filth. It is therefore not in the least degree surprising to be told that some sewermen even show marvelous health and activity. The strangeness of the story would come out if the facts lay the other way. Let no mistake, however, be made as to the moral. Arsenic is not the less an active poison, working death with certainty, because there are arsenic eaters who thrive and grow fat on what kills men not habituated to its use. If the whole population lived in the sewers, the mortality would be considerable, because the weakly and susceptible would be killed off with great celerity, but the survivors would be extremely unlikely to suffer from either typhoid fever or diphtheria."

The experienced and fully-informed mind reflects that observations may not have been sufficiently extensive or not sufficiently extended as to time; that as vital questions involve many factors some may have

been overlooked or not duly considered; that an important element may be recognizable by consequences that appear at a remote date; that the results of evil practices may be found nearer the end of life, or that children born of those living in such unfortunate circumstances thence inherit a feebler organization and low vitality. All statistics and classified observations confirm what nature seems to teach, that mankind is best off with pure air, pure water, good food and cleanly surroundings. The notice taken of the exceptions shows that the unexpected or the unnatural has happened and comparisons of these confirm the rule.

SEWAGE DISPOSAL.

For the year past no subject has more earnestly engaged the attention of our cities and larger towns than that of the disposal of sewerage. For a long time many of the citizens of Trenton have felt the need of an enlarged and consistent system by which its rapidly-growing population could be afforded facilities for the removal of all fouled liquids. Here and there short sewers are to be found, but most of the householders have been compelled to depend upon cesspools. Every year since the securement of an abundant and excellent water-supply has but increased the demand for some better method of riddance than that of soil-soakage and that occasional emptying of cesspools which approaching overflow forces. The city has had a well-devised plan furnished by Rudolph Hering, and, with tardy endeavor and some complications, is endeavoring to enter upon a systematic plan for the construction of a main sewer, which will prepare the way for a complete sewerage of the entire city. It is always to be remembered that sewers, by the line of opening they make through the streets, as well as by the amount of liquids they remove, do much to dry the soil, and so are of great advantage for drainage as well as for sewerage.

Atlantic City has extended its sewer system through all its principal streets. The sewage is brought to a central point, from which it is daily pumped, while fresh, to what are called filtering beds on a meadow just in the rear of the city. Too much cannot be said in praise of the energy with which a few of the citizens have pushed forward the enterprise and have thus rid this growing center of the cart and cesspool nuisance, which once threatened its health and its fair fame. We trust and believe that the same spirit of enterprise

will not permit the miserable apologies for filter beds which were started in the rear of the town to remain in their present locality, or indeed anywhere, to be passed off as filtering or precipitating works in any modern sense of the terms. We are glad to know that the city has it in its power to control the locality of the final filtering and precipitating tanks. We also insist that the most careful expert oversight shall be exercised over the works, both as to the mode of precipitation and the effluent. Having introduced an excellent water-supply and having made a liberal outlay for a sewer system which can be made very efficient, it only remains that by constant vigilance there shall be secured to the thousands that tarry both summer and winter at this resort the healthful attractions of which the city and the State are so proud. A list should be furnished each year of those who avail themselves of the water-supply and of the sewage removal, so that strangers and citizens may avoid the localities which still insist upon cesspools and middens and furnish drinking-water from surface wells in the soil.

The city of Orange, under the direction of Messrs. Bassett and Hering, is executing a most important sewage system. The method of removal and precipitation adopted is in accord with the advanced views that now obtain as to the feasibility of clarifying the sewage so as to furnish an effluent which may go into the streams. The works will be found worthy of a visit by all who are interested in the newer methods of sewage disposal.

Long Branch City, after many tribulations, has at last entered upon a well-devised system of sanitary improvement. We have carefully examined the works during the process of construction, and can claim for them many great advantages. If the methods of precipitation and discharge provided for are thoroughly carried out we shall not be disappointed in results.

In Newark the system of sewerage which was acted upon last year is being carried forward.

There are several others of our cities and towns which are giving attention to this subject. It is believed that most of them are recognizing the importance of arrangements for preserving the soil and the air from pollution, and of delivering the soil from that additional amount of water, which is always so greatly increased where there is a public water-supply unless there is provision for the removal of all sewage liquids entirely away from the ground and soil of the cities.

The State Board of Health has several times during the past year been called upon to advise with the Managers of the Morris Plains Asylum and the engineer in charge of their contemplated sewerage system. As the original building plan did not provide for any disposal of the sewage except its immediate passage into a small adjacent stream, and as the pollution had become considerable, it was necessary to devise a plan which would dispose of the sewage so as not to be hazardous to health or a constant discomfort to the increasing population locating in that vicinity.

After a careful inquiry into the adaptation of the various usual methods for the disposal of sewage, the Managers concluded to make use of a gravel field belonging to the Asylum property, and to dispose of the sewage by a modified system of subsoil irrigation. While this, like other systems, does not give an absolutely pure effluent, it does, under proper administration, dispose of the sewage in a way that is not hazardous to the public health and not disturbing to the public comfort.

It is fortunate that several of our most prominent engineers are giving careful attention to the various methods of sewage disposal, and that there is a tendency to place all such public works under the superintendence of skilled oversight.

The reports heretofore presented by the Board have discussed the various more usual methods of sewage disposal, and especially the broad irrigation, the intermittent filtration, and the sub-irrigation systems. The broad irrigation and the intermittent filtration systems, alike, make much of the two facts that earth is a good filterer, and that sewage has a fertilizing and so a pecuniary value.

Practice shows that the filtering capacity of soils depends very much upon their character and upon the underlying strata, and is much affected by the fact that so much water has to be found upon the ground to convey to it the organic matter. Indeed the intermittent filtration system grew out of the fact that the land became water-soaked, and that it is necessary to alternate so that between the applications of liquid sewage there should be such respite as would dry the ground and give to air free circulation through it. Overdoses of sewage soak the ground and expel air and so pollute the ground. It is no filter in such cases.

As to the pecuniary value of sewage, the views of Sir Joseph Bazalgette, the distinguished English engineer, are mostly maintained, viz.:

that most sewage has no *practical* value. It involves the entrance upon farming on a large scale on the part of corporations. The dilution of the sewage is such that it is not easily added to the soil with much fertilizing effect. While we believe it to be the most expensive method of dealing with town sewage, yet, where it has been accurately carried out, it has been effective. We believe it must be admitted that if all details are fully observed, and if the very best farmers and gardeners are employed, it furnishes a purer effluent than any other method. The soil is not to be lost sight of as a wonderful disposer of organic matter and of water. In many a single house or small village it is practicable by means of systematized application of suds, kitchen-washings and vault-material upon the ground, away from wells and in trenches between rows of rapidly-growing vegetation to dispose of household refuse.

While irrigation and intermittent filtration are allied, it is easy to see that the latter may succeed where the former would fail. The latter gives better advantages for aeration and for appropriation by growing crops. What is sometimes known as the sub-filtration or irrigation system, and also as the Waring system, depends upon tubes of tiles laid in well-drained ground, which are intermittently supplied with sewage. This air and sewage alternately circulate through the open tile drains, made from 8 to 12 inches deep so as to bring the plant-food within the reach of growing crops. The natural richness of much of the land of this country, the availability of compact artificial fertilizers, the freezing of the ground and heavy snows put limits upon each of these three systems in this country more than they experience in Great Britain, but upon this last the least of the three.

On the other hand, the putting of fresh sewage into streams not used for water supply is often more practicable than the same methods abroad. Our rivers are larger and more rapid in current. The careful examinations of chemists show that with our strong winds and abundance of sunshine rapid appropriation of organic material takes place.

No system has of late been coming into such prominence as that which is sometimes called the mechanical and chemical method of dealing with sewage. It depends upon the fact that by straining and then clarifying the sewage by chemical methods, the effluent or remaining water is so greatly improved in quality as to be easily disposed of in rivers.

The mechanical straining at the end of a series of pipes shows that such maceration of the grosser or more solid matters has occurred as to render the undissolved portion so small as to be easily disposed of. It has long been known that some chemicals would settle or separate much of the crude matter; but the difficulty has been that the precipitate, in the form of sludge, was itself still quite bulky, and that ammonia and phosphoric acid and some organic matter still remained in the effluents. But one improvement after another has shown progress in the systems of clarification so as to provide purer effluents. Thus the Committee of the Metropolitan Board of Works (London) found that by precipitation, by the addition of 1 grain of protosulphate of iron, and 3.7 grains of lime to each gallon of sewage, followed by subsidence in settling-tanks for one or two hours, the liquid was very greatly improved. Four eminent chemists, Abel, Odling, Williams and Duprè, regarding the effluent not pure enough to admit into the river for the summer months, further subjected it to the oxidizing action of manganate of soda and of commercial oil of vitriol. This method proved so valuable that it rendered unnecessary the expensive method of filtration which had before been relied upon by means of land. There can be no doubt that precipitation is available primarily and as an aid to filtration when this is needed.

The difficulty as to the disposal of the sludge has been met by a method of reducing its bulk so as to make it transportable at a rate which will render it available in agriculture. The use of the Johnson filter press, or of the Muirhead press, as used at Maidstone, England, have much facilitated the application of this process. By this means the sludge is compressed into dry cakes, which can be disposed of easily, and in many districts help to repay in part the expense of their compression. The report of the Thames Commission, after a very careful comparison of methods, recommended the application of the mechanical and chemical method to the London sewage. A careful reviewer in the London *Lancet* says of it, that "precipitation and sludge filtration have given satisfactory results wherever they have been properly tried." The works at Coventry, Leyton, Salisbury, Aylesbury, etc., show the system in practical and successful operation. The report of Dr. C. M. Tidy and Prof. J. Dewar, as to Aylesbury, is full of interesting descriptions and facts. In a paper of Dr. Tidy more recently presented to the Society of Arts, London, he states the following five points as essential:

"(*a*) That the sewage must be treated while fresh; (*b*) that the sewage should be strained before chemicals are added; (*c*) that sufficient chemicals be added to effect complete purification; (*d*) that after the addition of chemicals the mixture be well stirred; and (*e*) that there shall be efficient tank accommodation."

There are some that insist that all this does not remove minute organisms. The answer made to this is, that it deals with sewage while harmless and valuable organisms are present, and that it removes the food on which the microphytes of disease feed. It also aids in oxidation and in other chemical transformation. Some who admit the great value of the process, claim that it is not enough alone for great quantities of sewage in large cities, but is valuable because the effluent which remains can then be passed for filtration into a much less area of land and be more thoroughly cleansed. According to the important researches of Mr. Warington upon "nitrification," much of the purifying action, which is usually termed oxidation, is due to the action of minute organisms. His experiments seem to show that these are never present over two feet below the surface, and that only soil to this depth can be relied upon for the treatment of sewage. If those views which have been accepted by others are correct, it is an additional reason why any effluent which is to be treated should be, as far as possible, cleaned of organic matter before transmissal to the deeper ground.

Sulphate of lime, alum, and the iron sulphate, are now most relied upon for this method of cleansing sewage. Great progress is being made in our knowledge of methods, and still more in such relative adjustment to localities and such skilled oversight as insures success.

In country places and single houses the cesspool is being substituted, by methods which keep the sewage within eighteen inches of the surface, or so disposes of it as that rows of grass or Indian corn or other rapidly-growing products may utilize it. There is a perceptible growth of knowledge in our own State, and we often find among township Boards of Health those who are informing themselves as to the best methods and the details of their successful application.

While it is neither possible or our desire to express preference for any one system of sewage disposal, since there are several successful plans and the question of choice is rather one of locality, we yet desire to draw attention to all the various methods and to have choice made under expert direction.

POLLUTION OF RIVERS.

This subject has attracted great attention in some of the closely populated cities of the old world, because so many of the rivers have been used as a source of water-supply, because of the crowded population on the banks, and because they not only received the sewage of these populations but the refuse of the numerous manufactories near them. It should receive the same attention with us since already some of our rivers have just the same conditions. Cities need to decide whether their rivers shall be used as the water-way for sewage or for potable water. They should not be used for both. Where several cities are on the banks of the same stream it is very possible for those on the upper waters to obtain a sufficiently pure water-supply, when it would not be for those near the outfall. It is important neither to overstate or understate the risks from the introduction of sewage into streams. It is a fact that fresh sewage admits of great purification in being mingled with large and rapidly-flowing streams. The study of natural processes, of animal and plant life, of the laws of organic matter, the examinations of chemistry and biology and the experience of physicians agree that often in the distance of a few miles the risks from sewage are much diminished. But, on the other hand, it is to be recognized that we should avail ourselves of sources of water-supply free from all risks. In the State of New Jersey there is not a town that cannot avail itself of a good water-supply. Our larger cities near New York have it in their power to secure water-rights such as will be of the greatest financial as well as sanitary benefit. Some of our rivers can thus be readily and profitably used to aid in the removal of the sewage. Others will need to be guarded with jealous care so as to be made available for a drinking-water supply. Still better can we avail ourselves of the abundant supplies amid the hills and mountainous districts of northern New Jersey, and of that deep underground supply which is found beneath nearly all of the cretaceous formation.

PUBLIC WATER-SUPPLIES.

The importance of a pure source of supply of drinking-water is impressed by the numerous cases in which disease is traced to the use of foul water. As a rule, no specific disease is produced, but there is

diarrhœa or some waste of vital force in overcoming the evil. As water is rapidly absorbed without digestive changes, and as it passes to every part of the system, it seems more apt to cause disturbance than either improper air or improper food.

The convenience of having water introduced into houses is leading many of our smaller but growing towns to inquire as to the best sources of supply. Unfortunately, it is a subject upon which a great many promiscuous opinions are given. We can point to several towns in which serious mistakes have been made. Generally it has been because no expert guidance has been sought. In some cases the whole matter has been placed in the hands of some outside company, which is made so independent as not to be directly responsible to the governing authorities. Even where the company is formed by the most wealthy citizens, it sometimes comes to be too much managed as an investment. While we know of some exceptions, the rule is that those towns are wisest that own their own water-supply.

Where this is not possible or at first feasible, the city should have the right of purchase on well-defined terms. It is unfortunate that several of our cities in the vicinity of New York have not before this perfected a plan of general supply. It should be done without delay. Several of our cities which have a public water-supply depend on wells. In such cities the Board of Health should have a record of the wells and particulars as to their location and depth. A comparison of cases of sickness among those using the public and private water-supply is often desirable. The last season we have had occasion to trace an outbreak of typhoid fever depending on a well, and another on a cistern. Cases of dysentery or other intestinal disturbance are very often attributed to poor water by the attending physician. The use of driven wells is largely on the increase in the State. Asbury Park and Vineland are attempting a public water-supply from this source. The relations of our mountains, our forests, our valleys and of our water-bearing strata are such as to insure a full and pure supply. It is culpable carelessness for us not to avail ourselves of these ready and abundant sources.

During the past year, more of our smaller towns than ever before have either resolved upon a public water-supply or are seeking sources from which to derive it.

WATER AS AFFECTED BY LEAD PIPES.

The use of lead pipes is so common, and so many cases of lead-poisoning by water drawn through them have been reported, that the subject is well worthy of more extended inquiry. At one time block-tin pipes, or tin-lined lead pipes, were advocated. These latter are subject to rapid corrosion, as the least exposure of lead in the presence of tin produces a voltaic action. It was at first found that very soft waters dissolved the oxide of lead which had been formed by the combining of the dissolved oxygen of the water with the lead much more rapidly than hard water. Further investigations of Frankland and others showed that the presence of sulphates, carbonates or phosphates in the water protect the metal because the oxide which is formed is converted into a basic carbonate or phosphate or a sulphate, but sparingly soluble. Thus the lead pipe became protected by a covering which underwent little change. If, however, free carbonic acid was present in the water, there was greater solubility. It was found that the different susceptibility of soft and hard water is not uniform.

During the past year, Professors Crookes, Odling and Tidy have made some very accurate experiments, which seem to show that the presence of *silica* plays a very important part. Provided excess of alkali be absent, half a grain per gallon of silica in solution deprives even distilled water of any continuous action on lead. On the basis of this fact, filters have been constructed in which the water passes downward, first through sand then through broken flints and then through limestone. Thus enough silica is dissolved to reduce the lead-dissolving power of a water noted for its danger in this direction to a minimum. We have the authority of these eminent chemists that thus the danger from the use of lead pipes can be overcome. Water companies may easily avail themselves of these simple provisions. The whole subject is so well stated in an editorial of the London *Lancet*, of October last, that wè quote as follows:

"The action of drinking-water on lead is a matter of such serious public importance, and is subject to so much apparent irregularity, that many investigations in regard to it have been undertaken. But the difficulties have not been entirely cleared up, and the further contribution to our knowledge, which was made at the last meeting of the British Association, is very welcome. The previous state of our knowledge may be summarized in a few words. The corrosion de-

pends on the solubility of oxide of lead in pure water. The dissolved oxygen, always present in water, oxidizes the lead, and the oxide dissolves as it is formed. Very soft waters, and above all distilled water, act powerfully and continuously. Some salts, when present, especially the salts of ammonia, increase the action, while others diminish it by a simple chemical action. Thus sulphates, carbonates, and, as was first shown by Dr. Frankland, phosphates, protect the metal remarkably. When new lead is exposed to the action of water containing any of these salts, oxide is indeed formed, but is immediately converted into the very sparingly soluble sulphate, basic carbonate, or phosphate, and the lead is thereby protected by a crust, which undergoes but little further change. On the other hand, any unusual quantity of free carbonic acid favors solution of the metal, for carbonate of lead, like the carbonates of calcium, magnesium, zinc and iron, is soluble in free carbonic acid. This soûrce of lead pollution has, we think, been very commonly overlooked. The net result of all these observations was the belief that hard waters had but little action, while soft waters were liable to exhibit a strong action on ordinary lead pipes and cisterns. Some apparent discrepancies were gradually explained. Thus the very soft water of the Bala lake was found to have little action on lead; but Dr. Frankland discovered that this was due to phosphates, which happened to be present in unusually large quantity. Other irregularities were, however, from time to time noted, and our knowledge remained imperfect, while there was no remedy suggested except the avoidance of lead, which would be very inconvenient, for block-tin pipes are too expensive, while tin-lined lead pipes, although excellent, require the greatest care in plumbing, as the least exposure of lead in the presence of tin produces a voltaic action which causes rapid corrosion.

"This, then, was the state of our knowledge when Professors Crookes, Odling and Tidy undertook the investigation, the results of which they read at the Birmingham meeting. They commenced systematically by dividing the waters into groups, according to their action on lead, and their tables show at a glance that the mere variations of hardness do not account for the variations of lead corrosion—that, indeed, a very soft water sometimes exerted less action than one which was considerably harder. But they were soon struck by a fact previously unobserved, which afforded the clue which guided them in their subsequent work. The least action was always observed in the water which contained the greatest quantity of silicic acid. Many more observations were of course made, which confirmed the earlier ones, and then a series of synthetical experiments were undertaken, in which silica in definite quantities was added to the water before exposing it to the action of lead. At first alkaline sodium silicate was tried, but as it was found worse than useless, dialysed silicic acid was substituted with perfect success. Then followed a series of trials with powdered glass, granite, flint, agate and chalcedony. All of these

had some beneficial effect, but flint was about the best, and subsequent experiments appear to leave no doubt that, provided excess of alkali be absent, half a grain per gallon of silica in solution deprives even distilled water of any continuous action on lead. It is, however, essential that the silication of the water shall be maintained, as otherwise corrosion will set in. Here there was not only an explanation of some, at any rate, of the irregularities which had previously been most puzzling, but the suggestion of a possible remedy.

"On these new lines, new experiments were made, and the result was that a system was devised which appears to be at once efficient and inexpensive, and which we trust will stand further trials, and take permanent place as one of the great achievements of applied chemistry. Filters were constructed in which the water passed downwards, first through sand, then through broken flints, and lastly through Buxton limestone. The water used was that of Huddersfield, which is very soft and dissolves much lead. After passing through the filter with uniform velocity, it was again analysed, and its action on lead again determined. The total solids in solution were found to have undergone very little actual increase—not more than about half a grain per gallon—but enough silica had been dissolved to reduce the "lead-dissolving power" of the water to one-thirtieth, the lead-dissolving power being the quantity of lead dissolved under similar conditions in a given time. If so simple a filter will protect all water from lead pollution, water companies will have no excuse if they do not adopt it; it cannot injure, and will probably in every case improve the water in all respects.

"The authors of this interesting research discuss in a separate section the question of the quantity of lead that may be permitted in drinking-water. They quote many authorities, and from them and their own observations conclude that a water is safe if a few ounces treated without evaporation with sulphuretted hydrogen gives no reaction."

The observations of Dr. Sinclair White, Medical Officer of Health for Sheffield, as to the cases of frequent lead-poisoning by the water from the hills about Redmires, also shows some important facts, and especially that the solvent action of the water upon lead is practically destroyed by keeping it in contact for a time with freshly-broken surfaces of limestone, and that even when the lead has been taken up. Many of the domestic filters in current use entirely remove it.

THE FILTRATION OF WATER.

This is deservedly a subject that attracts much attention. It is done on a large scale in public water-supplies and in connection with

reservoirs. Besides there are the numberless contrivances known as house filters. If these did nothing else but to remove materials in suspension they would be of some value. It is not only pleasanter to use clear water, but these suspended articles act as irritants and are to be removed when possible. But besides a good filter sends the water in close contact with minute solid particles and by the minuteness of separation aids much in aeration.

The chief objection that has been urged is that they do not remove matter in solution and that they do not remove the micro-organisms which are believed to be the chief causes of disease. If they aid in aeration and remove some organic matter, they favor chemical action and also remove the materials on which the micro-organisms flourish. But the recent experiments of Dr. Frankland seem to show more than this. He reports that a filter of ferruginous green sand, six inches in thickness, entirely removed micro-organisms at first. Their vitalitiy is greatly affected by agitation. The results of several recent experiments is to show that we need to restudy the value of various kinds of filters by the biological and chemical tests. Meanwhile it is to be borne in mind that a foul filter becomes the source of contamination. Many of the house filters do more harm than good. Those built on a large scale and with apparatus for washing and renewing the filter material are of great benefit. Those in use in private houses should admit of frequent refreshment or renewal of the filtering layers.

A recent paper on "Water Purification, its Biological and Chemical Basis," presented to the British Institution of Civil Engineers, by Dr. Percy F. Frankland, furnishes the following summary on the subject:

"The author stated that the earliest attempts to purify water dealt simply with the removal of visible suspended particles, but later chemists turned their attention to the matters present in solution in water. Since the advance of the germ theory of disease, and the known fact that living organisms were the cause of some, and probably of all, zymotic diseases, the demand for a test which should recognize the absence or presence of micro-organisms in water had become imperative. It was, however, only during the last few years that any such test had been set forth, and this was owing to Dr. Koch, of Berlin. By this means the only great step, which had been made since the last Rivers Pollution Commission, had been achieved. It had been supposed that most filtering materials offered little or no barrier to micro-organisms; but it was now known that many substances had this power to a greater or less degree. It had also been found that, in order to continue their efficiency, frequent renewal of

the filtering materials was necessary. Vegetable carbon employed in the form of charcoal or coke was found to occupy a high place as a biological filter, although previously, owing to its chemical inactivity, it had been disregarded. Being an inexpensive material and easily renewed, it was destined to be of great service in the purification of water. Experiments were also made by the agitation of water with solid particles. It was found that very porous substances, like coke, animal and vegetable charcoal, were highly efficient in removing organized matter from water when the latter came in contact with them in this manner. Also, it was found that the well-known precipitation process introduced by Dr. Clark, for softening water with lime, had a most marked effect in removing micro-organisms from water. In the case of a water softened by this process, it was found that a reduction of 98 per cent. in the number of micro-organisms was effected, the chemical improvement being comparatively insignificant. Water which had been subjected to an exhaustive process of natural filtration had been found to be almost free from micro-organisms. Thus, the deep-well water obtained from the chalk near London contained as few as eight organisms per cubic centimeter, whereas samples of river water from the Thames, Lea and Wey had been known to contain as many thousands. The waters supplied to London had been regularly tested during the last fifteen months, and the most important and valuable information had been obtained as to the efficiency of the processes to which the water companies subjected the water supplied by them in removing micro-organisms, the average reduction during the last four months of the past year having been 97.9 per cent. for the Thames and 93 7 per cent. for the Lea. The biological testing of waters was of especial value to water-works engineers, for they now had a means of ascertaining with exactitude the working condition of filter-beds, instead of following the empirical methods generally in use."

BATHING ACCIDENTS.

During the past year, public attention has been attracted to the apparent increase of accidents by drowning along the New Jersey coast. This Board, some time since, drew attention to the fact that the number of such accidents is much greater than is generally supposed. In one year our record showed 193 deaths from this cause. The Circular No. VII. issued by this Board as to the management of cases has been largely distributed, and has been of some service. While giving all-needed particulars as to modes of mechanical manipulation, it especially insists upon the value of the electric battery and the hypodermic syringe. The great error in management along the

New Jersey coast is in the absence of any efficient organization—prompt and skillful attention to recovered bodies.

The bathing master is simply a person who warns bathers of what he considers as dangerous, and answers a cry for help by swimming out to the bather if he considers it safe so to do. Often boats and ropes are not at hand. If a boat goes out, it has no person with the oarsman ready to deal with the recovered person before the shore is reached. A battery or a syringe for administering brandy are not near at hand. Even those not dead, on reaching shore, not infrequently perish. A child, the last summer, was drowned in Wesley lake, and a gentleman near Spring Lake, under circumstances which well illustrated the inefficiency of present methods. The waiting until the body is recovered, the running to and fro, the late arrival of doctors, batteries, stimulants and the promiscuous rolling about of the body would be commendable diligence on the part of belated sympathizers, if it were not possible to be shown a more excellent way. We once examined a member of a life-saving station as to his knowledge of methods, and were glad to find him fully acquainted with methods, although not having at hand some needed appliances. There is need of a life-saving bathers' association at the most populous resorts on our coast which will have all the advantages of organization and appliances, and be able to give system and skill to these efforts to rescue and revive those who have become exhausted in the water. This Board will be glad to co-operate in organizing any such remedial or preventive system. The result would not only be the recovery of more, but the prevention of so many exposures.

IMPORTATION OF RAGS.

During March, 1886, and for some time subsequently, this Board had occasion for considerable correspondence as to the importation of rags. It occurred from the fact that by consent of the United States Treasury Department, old rags imported from foreign countries are admitted to entry at the custom house of any city or other locality upon the production of a permit from the health officer or Health Board thereof. The requirements of the port of New York being somwhat strict, Perth Amboy and some other ports in New Jersey afford convenient ports of discharge if the permission of the local health authorities can be secured. In the case referred to, the

authorities of Perth Amboy allowed the removal and reshipment of the rags. The Secretary of the State Board made a full investigation of the general facts as to the subject of rag importation, and as to this special case. The whole matter was carefully considered by the Board. While this particular case did not call for the exercise of the powers conferred by Section 9 of the General Health Law, it is evident that any period of epidemic or its threatening may require the exercise of this power. Until there is some more definite action on the part of the general government, each case needs to be dealt with in reference to the port of lading and other facts. But our health officers are cautioned as to the danger that may arise from any lax methods of inquiry. This Board will exercise the power conferred upon it if any case of exigency arises.

THE REGULATION OF CEMETERIES.

The proper location of cemeteries and grave-yards has this year been brought prominently into notice by the granting of a temporary injunction as to the Wehawken Cemetery in Hudson county. The facts presented in England, by Edwin Chadwick and many other authorities, as to intramural interments, have been fully corroborated. The investigations of Rauch, Wickes, Warman and others in the United States fully confirm the view that there should be legal and sanitary regulation as to cemeteries. Our own State law requiring the consent of Boards of Health in the location of cemeteries is valuable. Great care should be exercised in the choice of suitable soil and elevation of site, and suitable position as respects houses and sources of water-supply. There also should be regulations as to sufficient space, and as to the management. The following selection from the directions of the local Government Board of Great Britain will be found of value:

"I. The soil of a cemetery should be of an open, porous nature, with numerous close interstices, through which air and moisture may pass in a finely divided state freely in every direction. In such a soil decay proceeds rapidly, and the products of decomposition are absorbed or oxidized. The soil should be easily worked, yet not so loose as to render the work of excavation dangerous through the liability to falls of earth. It should be free from water or hard rock to a depth of at least eight feet. If not naturally free from water, it should be drained if practicable to that depth; to this end it is necessary that

the site should be sufficiently elevated above the drainage level of the locality, either naturally, or, where necessary, by filling it up to the required level with suitable earth.

"Loam and sand with a sufficient quantity of *vegetable mould*, are the best soils; clay and loose stones the worst. A dense clay is laborious to work and difficult to drain; by excluding moisture and air it retards decay, and it retains, in a concentrated state, the products of decomposition, sometimes to be discharged into graves opened in the vicinity, or sometimes to escape through cracks in the ground to the surface. A *loose, stony soil*, on the other hand, allows the passage of effluvia.

"II. The situation of a cemetery requires consideration from several points of view, of which the most important are its position with reference to dwelling-houses and sources of domestic water-supply. While public convenience requires that the cemetery shall not be too far distant from the population for which it is intended, a due regard to public health requires that it shall not be dangerously near. The most suitable distance will vary in different cases; it will be greater in the case of a large than of a small cemetery, greater also in the case of a large and rapidly extending town than in that of a small and stationary village.

"In view of the evils which in former times have undoubtedly arisen from the practice of intramural sepulture, and also because the erection of houses near a cemetery interferes with the free play of air around and over it, it is desirable that the site of the cemetery should be in a neighborhood in which building is not likely to take place, and also that so far as practicable a belt of ground should be reserved between the graves and the nearest land on which a house may be built, in order to obviate to some extent the risk of contamination of ground air and subsoil water with decomposing matters. This is especially necessary where houses are constructed with cellars. It is, therefore, highly desirable that interments should *not* be made up to the extreme edge of the cemetery, and it would be possible without great waste of space to reserve in all cases a strip of ground free from interments, 15 to 30 feet in width, around the whole cemetery on the interior of the boundary fence. This strip would afford room, on the inside, for a gravel or asphalt walk to give access to all parts of the cemetery, and on the outside, next the fence, to a belt of trees, the rootlets of which penetrating the soil would arrest and assimilate any decomposing matters percolating to the exterior of the cemetery. Obviously a cemetery should not be placed on elevated ground above houses, where the soakings from it may percolate to the sites and foundations of the dwellings below.

"The precautions to be taken to avoid pollution of wells and springs in the neighborhood of a cemetery will depend much upon local circumstances; they may be said to be, 1st, the intervention of a sufficient space between the cemetery and the water source; 2d, proper drainage,

so that the subsoil water of the cemetery shall be conveyed away; and 3d, proper management of the cemetery, so that the amount of organic matter in one place shall not be more than the soil can dispose of. The English acts and regulations prescribe no limit of distance from water-supplies within which a cemetery is not to be established, but it is to be taken for granted that a site would not be sanctioned if it appeared likely that the purity of existing water-supplies would be endangered.

"The length of time necessary to effect complete decomposition varies (the materials of coffins being similar) according to the nature of the soil, being shorter in a porous well-aerated soil, than in one which is either dense and clayey, waterlogged, or surcharged with animal matter. The regulations of the Home Office prescribe that no unwalled grave shall be reopened within 14 years after the burial of a person above 12 years of age, or within 8 years after the burial of a child under 12 years of age, unless to bury another member of the same family, in which case a layer of earth, not less than 1 foot thick, shall be left undisturbed above the previously buried coffin; but if on reopening any grave the soil be found to be offensive, such soil shall not be disturbed, and in no case shall human remains be removed from the grave.

"The size of grave spaces prescribed by the Home Office is 9 feet long by 4 feet broad = 4 square yards, for an adult, and for a child under 12, 2 square yards, viz., either 4½ feet by 4 feet, or 6 feet by 3 feet. This size, which may be recommended to sanitary authorities for general adoption, allows the retention of a strip of undisturbed ground about two feet in width between every two adjacent graves. In any case it is important that each grave should be at least a foot distant from the nearest graves on every side, not only to prevent the passage of effluvia into the open grave from decomposing bodies in the adjoining graves, but also to avoid the danger of falls of earth, which may happen if excavations are made too near to ground which has been previously disturbed.

"The amount of space required for each 1,000 population will vary to some extent with the death-rate; but where the mortality is high, a larger proportion of the deaths will be those of persons under 12. More space will be required for an increasing than for a stationary population. Taking average numbers, in a stationary population of 1,000, there will be 22 deaths per annum, of whom about 8 will be under 12, and 14 above that age. For the interment of the persons above 12, $14 \times 4 = 56$ square yards of ground will be required yearly, and as these grave spaces will not be again available, if the above-quoted rule be observed, until after the lapse of 14 years, at least 784 square yards must be provided for them. Similarly, for children under 12, $8 \times 2 \times 8 = 128$ square yards at least will be required, making a total of 912 square yards. The necessary paths and buildings usually occupy at least a sixth of the surface. We thus get a minimum allowance of something near a quarter of an acre,

= 1,210 square yards per 1,000 inhabitants, which is the usually estimated minimum. The desirability, however, of providing more than this bare minimum of space is obvious and is generally recognized."

So long as the present unsanitary methods of coffining and boxing bodies prevail, it is not surprising that advocates for cremation are found, and that no uniform rule can be given as to the time needed for decay. As it is, we must needs be guided by the opinions of careful observers and the facts of experience. Churches and school-houses located amid grave-yards, and provided with furnaces in the cellars, are especially hazardous.

Thus far three maps of new cemeteries have been filed at this office.

HYDROPHOBIA.

During the past year the attention of the public, of medical men, and especially of sanitarians, has been drawn to the treatment of hydrophobia. What is known as Pasteur's method could not but excite the interest of every one that feels for those subjected to such a terrible malady. Our own interest has been enhanced by the cases of the Newark children, although it must be confessed that they throw no light upon the success of the treatment. The hope of Pasteur and the plan of his treatment is a natural outgrowth of what may now be called one of the most encouraging prospects of sanitary science and art. It is based upon the idea that a large number of the communicable diseases result from the introduction into the system of a specific micro-organism or microphyte. This has been certainly proven as to the disease known as anthrax or splenic fever, and has been rendered very probable as to several other diseases. It was a bold thought to apply the principle to the treatment of so obscure and virulent a disease as rabies. Knowing that the virus of other diseases had been attenuated or made benign by successive inoculations and by exposure to the oxygen of the air, Pasteur thought that in the case of rabies the virus was most likely to abound in the brain and spinal cord. It was found that this taken from the rabid dog and injected into rabbits would quite uniformly produce the disease in fifteen days. That the disease thus produced is the same seems to be proven by the fact that the virus taken from the rabbits will in turn cause the disease. It was found that the virus was made more intense by inoculation in

rabbits; also that it could be secured of varying degrees of strength by varying periods of suspension in dry air. The temperature and the thinness of the cord exposed govern as to the time needed. It is thus possible to have pieces of different degrees of virulency. Thus the operator is able to begin with virus of the lowest virulency desired, and at stated intervals introduce that of higher potency. Pasteur, having tested the method on lower animals, made his first successive inoculations on the human being July 6th, 1885, on a boy that had been bitten July 4th. Since then large numbers have been operated upon with apparently as uniformly successful results as could have been expected. It is not reasonable to claim that the treatment is not sustained because there is an occasional exception. The case is well stated by Dr. C. R. Drysdale, the senior physician of the Metropolitan Free Hospital, of London, as follows. Under date of June 3d, 1886, he says:

"Having during the past week seen more than 250 inoculations performed in the Rue Vauquelin, and read over a number of the histories of patients operated on by Dr. Roux, I have come to the conclusion that there is no longer any reasonable doubt of the immense advance made in therapeutics by M. Pasteur's process for the cure of hydrophobia. The statistics are so telling that no one, I think, can read them without feeling convinced that an all-important discovery has been made. M. Grancher, whose abilities as a physician all are aware of, takes the date of April 22d, 1886, as the one which allows of his drawing a conclusion warranted by the length of incubation of hydrophobia, and then shows that M. Pasteur has treated ninety-six cases of persons who had been bitten by dogs which were proved to be rabid because other animals bitten by them had died rabid, or because rabbits inoculated from their brain and spinal cord had succumbed to the disease. Of these ninety-six cases there was only one death. Again, of 644 cases of bites by dogs which were certified as rabid by the veterinary practitioner of the commune when they were bitten, only three of those treated died. Taking these two groups together, the death-rate of those treated was only 0.75 per cent., against 16 per cent., which is the death-rate assigned to a similar set of cases by M. Leblanc, Veterinary Surgeon of the City of Paris, where patients had been treated by other methods. In addition to these, M. Pasteur has treated forty-eight persons bitten by rabid wolves, and seven of these, or 14 per cent., have died, whereas the death-rate of persons bitten by wolves has been shown by M. Brouardel to be 66.5 per cent. Putting these facts together, M. Grancher contends, with truth, that Pasteur's treatment is twenty-three times as successful against the bites of dogs as the treatments of past times."

November 2d, 1886, M. Pasteur read before the French Academy of Medicine a paper giving a grand result of the first twelve months of his hydrophobia inoculations. During that time 2,490 patients, a vast proportion of whom had been bitten by dogs undoubtedly mad, had been treated by his method. Of these 1,700 came from France and Algeria. Out of the entire number only 10 succumbed. M. Pasteur assumes that very few persons bitten in France during the past year neglected to visit him.

Much of M. Pasteur's communication dealt with the improvements and modifications adopted in inoculations since the death of the three Russians. The inoculations are now stronger, more rapid and are made with fresher rabic matter. He thinks these statistics are ample proof of the success of his method.

The English Commission and Surgeon Sternberg and other cempetent experts have confirmed the accuracy of the methods and the reliability of the statistics, if indeed Pasteur's methods needed any such testimony. This does not mean that the feasibility of inoculating all persons claimed to have been bitten by mad dogs is proven, or that there is not yet much truth to break forth on the entire parisitic theory of disease. But as this mode of treatment is in the direct line with the treatment of anthrax, chicken cholera, etc., and as the relation of micro-organisms to several communicable human diseases seems highly supposable, it at least becomes the sanitarian, in his study of the causes of disease, to keep such facts close in view.

In the meantime, we are not to forget that very many bitten by rabid dogs do not develop hydrophobia; also that there is reason to to believe that rapid and thorough attention to the bitten part is of great importance. The direction given by the chief surgeon of the London metropolitan police, in a recent circular and in view of some recent studies, is as follows: "When possible, apply a ligature above the part bitten; have prompt and thorough suction of the wound, freely washing it with water and applying absolute phenol (pure carbolic acid). The person sucking the wound (usually the patient himself) should spit out all matter sucked and freely wash out the mouth with water. A punctured wound should also have a crucial incision."

Another good direction is as follows:

"The wounds should be most thoroughly washed out—deep wounds by means of a syringe—with a warm, weak solution of permanganate

of potash; punctured wounds being first incised, and bleeding encouraged. After this has been done, each wound should be carefully wiped, and powdered permanganate of potash rubbed into it. When the wounds are deep, injections of a 5 per cent. solution of permanganate should be had recourse to. Now, what are the objects of this treatment? They are (*a*) to cause the expulsion of as much of the virus as possible; (*b*) to neutralize any virus that may remain; and (*c*) to cauterize the part so as to convert it into dead tissue, which, as we know, is incapable of performing the process of absorption."

SMALL-POX AND VACCINATION.

It is quite noticeable that at periods varying from five to seven years there is apt to be in all larger cities an epidemic of small-pox. The same is true to some degree of scarlet fever and measles. This does not arise from any ascertainable law of periodicity, but is believed to be owing to the fact that this is the period of first school age in which so many children who have been kept at home come to mingle more fully with the outer world. In the case of small-pox all this might be prevented if only vaccination was thoroughly practiced. It is generally neglected by a sufficient number to furnish the material for its propagation and extension. On this basis small-pox will soon be due in some of the larger cities of the State. The outbreak in Canada has been more extended than otherwise, because of a superstitious opposition to compulsory vaccination on the part of the Canadian French. Cases have recently occurred in Philadelphia and Brooklyn. It is a disease so communicable that but few of the unvaccinated escape. Let local Boards at once take warning.

The law of this State, Chapter CLV., Laws of 1880, Section 10 (page 8 of Circular LIV.), requires that the enrollment by district clerks of schools should show what children within the school age are unvaccinated, and provides for vaccination at the expense of the township where the parents are unable to pay therefor. Section 11 of Chapter CLV., Laws of 1882 (page 10 of Circular LIV.), gives power to trustees of schools to exclude from school all unvaccinated children and teachers at the time when a case or cases exist in the vicinity. If the district clerks would inform families of these laws, and also urge the vaccination of younger children, it would greatly add to the public protection.

Circular XLIV. of the Board gives full directions as to the pro-

curement of lymph, and as to the precautions to be taken as to this and other communicable diseases. In Germany, since 1874, all children are required to be vaccinated in early childhood, and again at twelve years of age. The diminution of the disease has fully justified the law. The same can be said in England, where vaccination is also compulsory. We have believed that in this country we can attain the object better by information, persuasion and the provisions of the school law. We need to urge upon all teachers and all families, and all who have the care of children, the importance of ascertaining how many have been vaccinated, as also of urging upon all the need of attention thereto.

OUR SUMMER RESORTS.

Among the most important and successful industries of the State is the provision of places of resort for our own population and the multitudes from other States who have already found some of the great advantages possessed by New Jersey. It is not merely that its general location affords a medium between the rigor of the more Northern States and the heat of the Southern lands. The great diversity of mountain and valley, the number of natural lakes, the protection of great forests, the dry and warm character of some of the soils, and the beautiful expanse of sea-shore, with the very ready means of access from every part of the country, insures a constant increase of visitation and permanent population, if only the natural healthfulness of these resorts is carefully guarded; for it must be remembered that the tendency of the rapid aggregation of people in temporary resorts is always to deteriorate the standard of healthfulness. Much of the work is done in a great hurry. Jerry building, housekeeping regulated if not attempted by speculating men, water and cesspool arrangements by botchers, a fine show of exterior, and a slighting of that which the transient boarder is not likely to inspect, are the temptations presented. Too often the result is recorded in an unrefreshed return to the winter home, or in more sudden sickness.

This State Board early turned its attention to these places of resort, and by the aid of its inspectors and of owners, is generally able to secure the needed improvements. The exceptions are where some local Board slurs over its duty for fear of some wealthy owner of a hotel, or where the owner has such exalted views of his own sanitary

competency that he is ready to make crude devices of his own. We must insist that those who invite the people to come to places offered to them because of the claim of especial healthfulness, are under obligation to look to complete drainage, to a good water-supply, and to a complete protection of the soil from all pollution. An indignant professor, whose family got sick, has recently written an indignant letter on "The Risks of a Summer Holiday."

It is not fair to allure people to places called "health resorts," unless they offer special inducements in the line of health. It is reasonable to expect that they will be and be kept under the best sanitary administration.

"A moment's reflection must convince any one that the fact of any particular place having a high reputation for its hygienic qualities is certain to expose its inhabitants and those who visit the locality to special risks. The convalescent from maladies of all classes, and more especially the 'catching' diseases, always seek 'change of air,' and they are pretty sure to go, or be taken, to places, probably by the seaside, which are renowned for their restorative properties. Practically, therefore, just as a district naturally free from phthisical affections is sure to be crowded with the victims of lung disease, so a healthful locality is likely to be frequented by the unhealthy. There is no help for this, and the fact must be faced; but in so far as infectious or contagious diseases are concerned, there ought to be special measures taken to protect visitors to places of general resort for health purposes from the needless peril of unsuspected morbid poisons.

"We do not desire to overstate the perils which beset those who go from home to seek health, but it cannot be disguised that the danger indicated is a very considerable one. It is not enough to consult the death-rate of a locality, and to assume the sanitary perfection of a district which does not happen to have had many deaths from zymotic disease. There are many maladies which do not directly kill. It would be interesting, though painfully so, to be able to tabulate the cases of disastrous illness distinctly traceable to the contraction of diseases at health resorts which, having only an insignificant proportion of deaths from infectious disease recorded against them, contrive to keep up their character. In short, we should deal with disease rather than death, or rather with the prevention of both."

The following summary will show with what care such conditions are registered at the English resorts :

"The statistics bearing upon the recent health of English watering-places, published in the Registrar-General's Quarterly Return, just issued, must afford considerable satisfaction to the thousands who are

now migrating from our large towns to these holiday resorts. It appears that the mean annual death-rate during the three months ending June last among the more than a million of the resident population of forty-six seaside and inland watering-places of England and Wales did not exceed 15.6 per 1,000. This rate was 2.4 below the general rate in the whole of England and Wales, and 1.9 below the mean rate among the nearly eleven millions of persons living in the rural districts, comprising the country parishes with their small towns and villages. With regard to the zymotic mortality in these watering-places, the report is scarcely less satisfactory. The annual death-rate from the principal zymotic diseases in these forty-six holiday resorts was 0.97, against 1.55, the mean rate in England and Wales, and 1.36 in England and Wales exclusive of the seventy-eight large towns. No zymotic diseases were registered during the quarter in Weston-super-Mare or in Tenby, while the rates in the other watering-places ranged upwards from 0.22 and 0.23 in Torquay and Whitby, to 2.11 in Eastbourne, 2.15 in Southend, 2.16 in Folkestone, and 2.63 in Herne Bay. In most cases in which the zymotic death-rate showed an excess, this was due to the epidemic prevalence (during the three months ending June last) of measles or of whooping-cough. Measles was somewhat fatally prevalent in Hastings, Exmouth, and Blackpool; whooping-cough in Scarborough, Lowestoft, Folkestone, Eastbourne and Worthing; scarlet fever caused 6 deaths in Yarmouth; and diphtheria mortality showed an excess in Southend, Folkestone, Rhyl and Blackpool. It should also be stated that "fever," principally enteric, caused an exceptionally high death-rate in the watering-places on the Kentish coast, especially in the Isle of Thanet and in Dover. It would be judicious and useful to intending visitors if watering-places at this season of the year published monthly health bulletins readily accessible to the public. The health of English watering-places has now reached a general standard, and their reputation has most to gain from publicity and most to fear from false reports arising from the difficulty of getting promptly authentic information respecting their health and mortality statistics."

It is the intention of this Board to turn still more attention to these resorts, and to seek still more fully to protect those who resort to them. This is the highest interest of proprietors as well as of visitors.

Our own resorts, whether at Schooley's Mountain, at Lakewood, at Lake Hopatcong or Greenwood, or at the scores of towns and villages by the sea-side need to have good sanitary certification. They then will have greater numbers, longer seasons, and so many will be induced to make of them more permanent homes.

SANITARY CONTROL OF COMMUNICABLE DISEASES.

The plans for the control of communicable diseases have through past times undergone many modifications. One of the first was to flee from the sick and stone the physician in attendance because he had been exposed to contamination.

Another was to cast out as unclean those who were affected, or to practically kill them by neglect.

Next came the thought that as some one of these attacks seemed to secure immunity from future attacks, it was best to expose persons thereto under favorable conditions. This method never obtained much headway except in the modified exposure of inoculation for small-pox.

Next came the protection of vaccination, which has proved such a blessing in the prevention of variola. Unfortunately we cannot say with confidence that this has yet been practially extended to any other human disease. But what has been done as to splenic fever or anthrax among animals, as to chicken cholera and as to hydrophobia, at least excites great hopefulness that the sphere of this form of prophylaxis may yet be greatly extended.

At present, the three great advances that have been made are (*a*) in the hygienic care of persons and their surroundings; (*b*) in methods of general prophyloxis and disinfection, and (*c*) in the isolation and nursing of the sick.

The care of persons and surroundings has chiefly to do with a conformity to all the conditions of health in the individual, and such attention to drainage and cleanliness and all surroundings, and to all things received into the system from without, as accords with what are believed to be the laws of health. The methods of general prophylaxis and disinfection involve the use of certain materials known as disinfectants, for the purpose of destroying those particles which are believed to cause disease, or of depriving them of the soil in which they are wont to flourish. Some physicians also believe that the same principle is to be applied to persons, and therefore adopt in times of epidemic a treatment which they believe renders the human system sterilized to the culture of these disease-breeding intruders. The third method, that of isolation and care of the sick, has especially been productive of valuable results in late years. It has, over and

over again, been shown that by systematized methods contagious diseases are prevented from spreading to those of the same household, and that endemics do not become epidemics. This plan of separation is now almost universally recognized as desirable, besides such care of and attention to the patient, as to excretions and secretions, cleanliness and surroundings, and all good care-taking as dilutes, modifies or destroys all contagion-bearing emanations. Our chief difficulty is, that while among all intelligent physicians and nurses this view is held, practically it is, so often, not well applied. The physician often has not the time or is not impressed with it as his duty to see to the minute fulfilling of all details, although the result all depends upon this systematic and sustained minuteness. Upon it, to a very large degree, depends success in the prevention of epidemics.

THE BREATH AND DISEASE.

The importance of a proper condition of the mouth, the teeth, the fauces and the breath is not to be lost sight of in seeking to prevent the contagion of communicable diseases. We have good reason to believe that most of these diseases are communicated through the breath, or through organic particles conveyed thereby. If the mouth by rinsing, by cleansing of the teeth, and sometimes by the use of disinfectants, is kept in the very best condition, even where the disease exists or has existed, it is not near so likely to be transmitted.

We are more and more finding out, for instance, how often sore throat is communicated through the breath. There are many who believe that ordinary sore throats are communicable, as well as that they often form the soil in which specific forms like diphtheria find lodgment.

Dr. C. Haig-Brown, of Charterhouse School, England, in an analysis of 127 cases of ordinary tonsilitis, and in sketches of two epidemics of it, is convinced of its contagiousness. Follicular tonsilitis frequently affects all the children of a family. Independent of therapeutic value, we believe that the use of potassium chloride, ferrum chloride, quinine, sulphur and other disinfectants often prevents the transmission of throat affections.

NOTIFICATION OF CONTAGIOUS DISEASES.

Legislation has attempted to aid in preventing the spread of disease by laws as to the notification of disease. The law of this State is of

the most moderate and conservative character. It is committed to Boards of Health to determine its enforcement as the size or condition of their respective localities or the threatenings of special epidemics seem to demand. Provision is made to compensate the physician for the notification. The notification is not a public one, and does not necessarily involve an inspection of premises, if the physician in attendance has made himself acquainted with local conditions, and is satisfied that they have or will have no relation to the cause or severity of the attack and that there is proper isolation. We have never known a city systematically to follow out this course but that its health authorities were fully satisfied as to the benefit to the people.

Dr. Littlejohn, so long the medical health officer of Edinborough, informs us that while the municipal government is economical, the necessity and advisability of the system is so fully accepted that in 1882 he reported 7,063 notifications, and at an expense to the city of over £800. He regards it as among the most effective measures for the limitation of disease. Such is the testimony of the most experienced health officers of our own cities. In Paterson, where it is systematically carried out and aided by all the physicians, it has proved very valuable and acceptable to all concerned.

The right of a State, with or without compensation, to require such service of any class of its citizens, is such as it exercises when it requires license for one business and not for another; when it exempts a physician from jury duty, and does not exempt the equally busy druggist; when it requires co-operation in various forms and does many other things of which it judges whether public necessity and the public good requires it.

While it is not surprising that those who reason from individual cases and do not look at the broad relations of notification to the checking of diseases, fail to realize its necessity, and while some may claim that the householder should make the report, it is gratifying to know that in general the propriety of allowing Boards to require notification is conceded.

At a recent meeting of the American Public Health Association, the matter of *interstate notification* of disease, as necessary in addition to local notification, was prominently before that body, at the instance of the health officers of Canada and of Louisiana. On no subject brought before that body, composed mostly of medical men, have we ever known a stronger and more uniform expression of opinion.

If Boards of Health have, as one of their objects, the prevention of the extension of communicable diseases, it would seem to follow as a corollary, that they have the right to know where such diseases exist. It is a parody on ethics to class as professional family secrets the concealment from a health officer that there is small-pox in Mr. A.'s family, or that Mr. B.'s children are having the scarlet fever or diphtheria. Nor can any judicial decision be found to sustain any who, under the assumption of an invasion of personal rights, claim that law has no right to obligate those in attendance upon cases of contagious disease to help guard the public health by such a kind of certification of the fact as this State so considerately provides for. If any individual health inspector or officer is impudent or annoying, let not the principle be disputed because of the person. The prevalent testimony as it reaches us, is that the health inspectors often prove of great advantage not only to the public health, but to the particular households concerned, where the contagion exists.

TYPHOID FEVER AND DIPHTHERIA.

During the past year the Board issued a special circular as to typhoid fever and diphtheria. They have such undue prominence in all bills of mortality, and stand for so many days and years of sickness in those that recover, that they must receive our most diligent attention. We refer to the circular for certain facts as to them. More than any other of the communicable diseases their occurrence or severity is identified with the condition of surroundings. Upon these diseases more than any others, turns the decision of the question of origin, without an antecedent case. Such names as abdominal typhus, typho-malarial, cesspool and pythogenic fever seem to point to the fact that there may be modifications of old diseases that are hybrids, or somehow come to have an established type of their own. As to diphtheria, its relations to croup and to follicular tonsilitis and various forms of sore throat is still *sub judice.* The belief in its *de novo* origin is on the increase, but there is need of much close and recorded observation as to it. It is claimed that "on a slight and simple sore throat a diphtheric taint may be engrafted." Common sore throat is believed by many to be transmissible to those exposed to the breath. Dr. Haig-Brown is convinced of the contagiousness of tonsilitis. He sketches two epidemics that occurred in his practice.

Dr. Lees, of St. Mary's Hospital, London, says: "Many ordinary catarrhs are distinctly contagious." The following abstracts are from an address of R. Hingston Fox, M.D., in April last before the Medical Society of London:

"Tonsilitis and its relation to scarlatina and diphtheria has many suggestions worthy of thought in our dealing with some throat affections.

"Inflammations of the tonsils present manifold varieties and gradations. It is convenient to include in the general term 'tonsilitis' some forms of inflamed throat in which the implication of the tonsil is a less striking feature. The tonsils do not stand alone, but the mucous membrane in their vicinity is studded with nodules of similar structure—*i. e.*, of lymphatic tissue; these are most abundant on the back of the tongue at its root, but exist also on the sides of the faucial aperture. The presence of these lymphatic organs is an especial characteristic of the fauces, and inflammations of the fauces, involving these structures generally, may well be included in the forms of tonsilitis. Catarrh of the fauces, however, such as is associated with nasal and pharyngeal catarrh, will not be considered here; it involves the tonsil little, if at all, and occurs in a different class of subjects from that affected by ordinary tonsilitis. Passing over the specific varieties, due to syphilis, tubercle, variola, &c., we meet commonly with certain clinical types of tonsilitis. By *true quinsy* I mean the recurrent 'inflammatory sore throat' (Trousseau), which results in abscess in or (more often) about *one* tonsil. The sudden onset, acute pyrexia, and rapid inflammatory œdema are distinctive features. We come next to the common tonsilitis, long since clearly described by Dr. Ainstie, who distinguished it from the suppurative form. The term 'follicular' is often applied to this affection, being derived from the fact that the crypts on the surface of the tonsils, formerly called follicles, are often plugged with exudation (hence 'spotted throat'); it is a bad designation, since the word 'follicle' is now more often applied to the nodules of lymphoid tissue of which the gland consists. The name 'septic tonsilitis' is provisionally adopted here.

"A family of four children (age from four to eight years) began to ail three or four days after their return from the sea-side in September, 1884. The eldest girl was affected with headache, sore throat, coated tongue and loss of appetite. The other three children followed. Each was slightly feverish, the highest morning temperature (in the mouth) being 100.1°, 100°, 99°, and 100.8°. The fauces were red, both tonsils were swollen, and in one case they presented little pocky eminences. Within a fortnight all were well. Some of these children have at various times suffered from sore throats, true diphtheria, severe mumps, and rheumatism, as well as chronic enlargement of the tonsils. In searching for the cause of the tonsilitis, it transpired that, on their

arrival at home, the children had drunk greedily from a covered indoor cistern in which the water had stood stagnant and tepid for several weeks.

"These cases exemplify the leading features of septic tonsilitis in a mild form; its attacking a group of persons in one household, often children; the brief pyrexia; both tonsils are attacked at once, being swollen and reddened, and they may present small yellowish or grayish white patches. There is not the acute infiltration of the surrounding tissues seen in true quinsy. The cause seemed in these cases to be derived from impure drinking-water. * * *

"This disease has now and then prevailed in extensive outbreaks—either in a certain district, or in a school or other large institution. Instances of the first are reported by Dr. F. P. Atkinson and others, and by several French writers (Morell Mackenzie); of the second, by Mr. G. A. Cardew of Cheltenham, and by Dr. Haig-Brown of Godalming in a paper lately read before the Association of Medical Officers of Schools. Is there any connection between septic tonsilitis and true quinsy? Most English writers still make no distinction between them. Yet in typical cases they appear wholly distinct. Suppuration perhaps occurs in rare cases of the former affection, but this would not prove any connection with true quinsy.

"Tonsilitis, often of a severe type, is a prominent symptom in both scarlatina and diphtheria. This will be again referred to.

"We pass on to cases of a more mixed and doubtful character. In the proceedings of the Medical Society of London outbreaks of 'infectious sore throat' are described by Drs. Farquharson, Routh and Crisp. Dr. Routh's forty-six cases occurred in a public institution in which the drinking-water was impure. Three types were distinguished—simple cynanche, sore throat with diphtheritic patches, and scarlatina. Dr. Crisp's outbreak was located in Chelsea, along the river-side, and was attributed to the opening of some large drains. There were forty-two cases of 'mild scarlatina,' mainly in children, and fifty-six cases of 'epidemic sore throat' with large inflamed tonsils, mainly in adults who had had scarlatina already. Outbreaks of this mixed character have been described in several of Mr. W. H. Power's reports, and by Mr. Hartnoll, of Exeter; others have been recorded by Dr. Bond, of Gloucester, Dr. Mantle, of Chester-le-Street, and Dr. J. Craig, of Llandudno. The last three accord with the description of 'pseudo-diphtheritis,' given by Dr. H. Ashby, of Manchester, in the *Practitioner* (vol. xxxi., p. 414).

"These records show that it is not uncommon, in the presence of faults in the air or water-supply, for temporary outbreaks of mixed forms of tonsilitis to occur, sometimes infectious in their character. Cases which would commonly be described as scarlatina and as diphtheria, with others of mere tonsilitis, are found together, with cases of a mixed type, well-nigh impossible to assign to either of the former classes, and all apparently depending upon a common cause. Or the

latter type may alone be present (pseudo-diphtheritis). Such outbreaks seem to hold an intermediate position between tonsilitis and the specific fevers. This leads me to the following proposition: that scarlatina and diphtheria may be regarded as essentially forms of tonsilitis which have acquired infective characters; that is, they differ from other forms of tonsilitis in having the power of *infecting the system* generally, and producing the phenomena of a specific disease. In speaking of these diseases as forms of tonsilitis, I would not do so in any narrow sense. They belong probably to that large class of diseases whose poisons reach the blood by way of the lymphatic system, their distinguishing character being that they are prone to enter that system through the tonsil, setting up tonsilitis. In ordinary tonsilitis the poison scarcely gets further than the tonsil. The term 'poison' is here used as a convenient expression for the organic *materies morbi*, capable of multiplication, and including (it is probable) both a bacterium and the products of its growth.

"The products of its growth do, indeed, enter the system, and cause some brief constitutional disturbance; but the living poison itself has little power of overcoming the resistance of the tissues. The system is not infected by it; it soon dies or loses its toxic properties, being incapable of reproducing itself in the human body to any great extent, if at all. Other poisons of the same class, but better adapted for living in the human organism, thrive therein, infecting the system generally, and producing symptoms of graver character and longer duration—in fact, running through the course of a specific fever (scarlatina or diphtheria). Such a poison is able to go on reproducing itself in the human tissues for a considerable period, and without losing its poisonous properties, so that by the time it is (to adopt Dr. Fagge's expression) destroyed by the pyrexia which it has set up it has caused the series of lesions belonging to the specific fever. It has also by this time become enormously multiplied, and particles of the tissues containing the poison being shed and communicated to other human beings, set on foot in them like processes, being, in fact, *contagia*. Now, in the power which the poison possesses of so far overcoming the resistance of the tissues of the human body as to reproduce itself largely therein without marked deterioration, so that offspring remotely removed from the original stock still produce the same effects in the tissues of a fresh human subject—in this power may we not recognize the characteristic of a *species* of disease? Some affections—*e. g.*, various forms of infectious sore throat—possess this power in a limited degree, and chiefly when associated with septic conditions (as the presence of putrefying matter in air or water, &c.); but scarlatina has apparently an indefinite power of reproduction, and largely independent of septic conditions. In accordance with the doctrines of evolution, we may suppose that the specific poison has been gradually developed from the group of non-specific poisons of tonsilitis, which present a varying capacity of infecting the system.

"The above scheme contains much that is hypothetical, but it furnishes an explanation of the facts already stated, especially of the occurrence of 'intermediate forms.' Some further facts will now be added in support of the theory. It is a frequent observation, made by Trosseau and by many others since, that common tonsilitis is very prevalent when either scarlatina or diphtheria is epidemic. Again, all these diseases are often either dependent for their spread on septic conditions, or are more active under such conditions. Some believe that scarlatina occasionally arises *de novo* under such circumstances, whilst many consider that diphtheria so arises. 'A striking feature of scarlatina is the great variability of its symptoms and of its course.' (Fagge.) Tonsilitis is, I submit, the most constant of its symptoms. It is notorious that in mild, scarcely recognized cases of scarlatina, sore throat is the only symptom observed. Yet such cases often communicate the disease. In other rare cases it is stated that a rash has been present, and no affection of the throat. Space will not admit of reference to the literature of this subject; I will only say that there is fair ground for question whether a tonsilitis, too slight to cause any complaint, did not exist in all such cases. In some cases of scarlatina, again, we see the tonsils covered with a thick membranous investment. Thomas and others say that true diphtheria is then concurrent. Niemeyer, Senator, and I think most English authorities, hold, on the other hand, that diphtheritic pharyngitis may be the result of the scarlatinal poison alone. Whichever view be taken, there appears to be a close connection between these two diseases.

"Diphtheria has been classed as in an intermediate position between specific zymotic fevers and common local inflammatory diseases (Parsons), and some have even assigned it to the latter category. At any rate, it has not, as a specific fever, acquired the stability of scarlatina, measles, &c. Oertels (in Ziemssen's Cyclopædia) and Loeffler have ably maintained that the process in diphtheria is at first entirely local, the constitutional effects being due to a poison developed at the seat of attack—*i. e.*, at the fauces in ordinary diphtheria. The primary local lesion also presents great variety. Senator describes four chief types, ranging from simple catarrh to fibrinous exudation. Yet the peculiar paralytic sequelæ may follow in cases where the throat lesion was so slight as to be unrecognized. Some have maintained that ordinary tonsilitis is in rare instances followed by these paralyses. Such cases surely belong to diphtheria; nevertheless, the statement illustrates our present point—the closeness with which this disease approaches to ordinary tonsilitis—so that there is hardly a line of demarcation between them."

We are convinced that an antiseptic condition of the mouth and throat is among the most important protections in the presence of a septic atmosphere, and especially of those contagions which there is

reason to believe enter through the breath and are disposed to find lodgment and development amid the lymphatic tissue of the fauces.

It is to be borne in mind that the tonsils and, to some degree, the adjoining membrane, are studded with sacs or nodules similar in structure to Peyer's glands, and that their structure is that of absorbent glands. "The tonsils," says Fox, "being themselves nurseries of young leucocytes, absorb certain elements to minister to the growth of the white cells. If septic air or particles are passed over them or mingled with the spittle, these, too, admit of absorption." In my own experience I think I have often seen the local irritation of the disease before it has become constitutional. Yet so rapid is the absorption and so quick the affecting of the glands and the blood, that it seems to many constitutional from the start. Dr. N. E. Davies, M.R.C.S., of Sherborne, thus expresses some views we have long entertained:

"It is a disease, the germ of which originates in filth, overcrowding and bad sanitary arrangements, is surely one subject to considerable amelioration, and, under the improving conditions of civilized life, eventful extinction—a malady which, if the researches of Bretonneau, Loeffler, and other celebrated pathologists, prove anything, is at first a local affection, and, therefore, one that ought, almost as a natural consequence, to be within the reach of medical treatment. It is a noteworthy fact that the part first attacked by this disease is that which is most accessible to the diphtherial bacteria—namely, the pharynx; and it is not surprising that childhood offers, as indeed it does to most zymotic diseases, the most favorable ground for the growth and development of the subtle poison of diphtheria—a poison that respects no condition of life and sweeps off with remorseless impartiality the offspring of the peer and the peasant.

"During the twenty years it has been my province to treat this disease, I have found, almost without exception, that the outbreak at first has been due to the contamination of water or milk with sewage saturated with human excrement, or with the overflow of earth privies in low, damp localities, and an interesting illustration of this came under my notice two years ago, when it was my duty as medical officer of health to investigate the cause of an epidemic in a little village near Sherborne, where an entire family of five children were destroyed by it, and where numerous other cases occurred, some of which ended fatally. In this case a spring of pure water was conveyed down a hill in a leaden pipe; this opened into a stone trough, and from this trough it again passed underground through some earthenware pipes (which were not cemented properly together) into a second trough, and thence it ran as an open stream through a thickly populated vil-

lage lying in a valley about a quarter of a mile long. Now, between the two troughs I have mentioned was an open privy, the liquid contents of which had percolated through the earth, and thence through the joints in the earthenware pipes into the second trough, afterwards, of course, contaminating the whole stream in its downward course through the village. Now mark this circumstance: a few houses near the first trough used their water from that, and these escaped the epidemic; whereas, those who used their water from the second trough and from the stream suffered more or less; and the family in which, as I have mentioned, the five fatal cases occurred, went for their supply exclusively to the second trough, and therefore got the poison in its most concentrated form.

"Now, what does the history of this epidemic teach? That, at all events in its first incursion, the cause was strictly local, and that the bacterial poison had its origin between the two troughs, and in the most fatal period of the epidemic, infected its victims by the mouth and alimentary canal through drinking the water. I opine that, such being the case, it is only natural to suppose that in the spongy substance of the tonsilar glands the micrococcus finds a congenial home, and from thence by fibrinous infiltration and inflammation invades the blood and the whole system, and this in some cases so rapidly as to destroy life in a few hours. I call attention to this fact simply to show that an epidemic, at all events at first, spreads by direct contact with the poison—*i. e.*, by imbibition. Afterwards, as a matter of course, it may spread by other means, and its virulence be intensified by conditions of climate and atmosphere.

"For the present it is wise and right, I believe, to agree with Loeffler, Empis, Kellog, Avery, Bretonneau, and many other celebrated pathologists, that the disease is at first a local disease, and that the constitutional symptoms depend upon general infection from this local lesion, and their mildness or virulence upon locality, atmospheric conditions, age, heredity, and the surroundings, healthy or unhealthy, of the victim, and perhaps I may add, the amount of the poison that has been imbibed; and acting on this belief, how important it is, when an outbreak occurs, to endeavor in every way to localize it and prevent its spreading by means of contaminated water, milk, and clothing, or by intercommunication with infected areas, and by energetic treatment to stamp it out.

"My plan of treating the disease is as follows: I assume that the case is treated in its early stage—the only stage in which local treatment can really avail, for when once the blood becomes impregnated with the fungoid micrococcus or bacteria of diphtheria, the poison is then deposited in organs, such as the trachea or the bronchi, beyond the reach of local treatment; and it becomes a question whether the constitution of the patient can eliminate the poison, and nature, generous nourishment, iron, &c., once more re-establish convalescence. In the first place, in any affection of the throat I lose no

time in examining it, and watch carefully for the unmistakable wash-leather-like creeping deposit of diphtheria, or the symptoms of its sister diseases, follicular tonsilitis, croup and scarlatina; if it turns out to be diphtheria, I give a mixture containing six drachms of the tincture of the perchloride of iron to five ounces of sweetened water, and at this strength, *undiluted*, I insist that the child shall take every hour, for twelve hours, a dessertspoonful (if the patient is older or an adult, a much larger dose), and that this dose shall be repeated whether vomiting occurs or not. At this strength I find in that time, or a few hours more, that the growth has a shriveled look and its vitality is destroyed. I then reduce the dose and extend the intervals, and, as I believe, with many others, that iron has some specific power of arresting the septic action of the poison in the system, continue it for two or three days or longer, keeping up the strength with strong beef tea, milk and port wine; if these cannot be taken, I use an enemata every four hours of equal parts of beef tea, port wine and cream or milk. The advantages of this treatment over the local application of caustics is that it reaches every part of the pharyngeal tract likely to be affected, and is, as I mentioned before, strong enough, given in this way, to destroy the vitality of the fungus of diphtheria; and let me here impress the absolute necessity of keeping a thorough draught of fresh air constantly passing through the room, for how can it be expected that a blood poison can be eliminated if it is continually breathed again? As well might one attempt to resuscitate a person dying from inhaling a poisonous gas without first taking the sufferer into the open air. It is needless to say that this treatment, in the generality of cases, should be supplemented by giving barley-water, sweetened in the case of children, containing two drachms of chlorate of potash or other antiseptic drug, to the pint, but I prefer chlorate of potash, for it is not unpleasant to the taste, and children will drink it readily."

The chlorate of potash may as well be administered in the iron solution. A similar treatment, in less but frequent doses, for those who have been exposed to the poison will, we think, diminish the receptivity of the throat membrane and of the system and so prevent attacks. But it is still more important to *prevent* those conditions of foul dampness and confined polluted air, which either originate the disease or are the determining factors in its propagation and virulency. It is in the range and duty of our control far more than some imagine.

SANITARY OVERSIGHT OF SCHOOLS.

At the close of the last year, this Board, with the assistance of State Superintendent Chapman, had begun an inquiry into the sanitary con-

dition of the school-houses of the State. The inquiry has proved to be of even more importance and advantage than was anticipated. The small question-book which was prepared was of itself suggestive of many of the real needs of our schools. As one copy was sent to be kept on file for the reference of school boards, trustees and teachers, it serves as a constant reminder of defects. The inquiry revealed some oversights and neglects which were promptly remedied. In all other cases it placed before the State Superintendent of Education and before this Board the great defects in some of the school-buildings and their appliances. The response to these inquiries has been so complete that more than 1,500 replies are on file. They will be duly tabulated and analyzed for the school report, and furnish the basis for the common advisement of the two departments. It has so far attracted the attention of a neighboring State as to have received therein the following notice:

"THE SCHOOLS OF NEW JERSEY.

"This sanitary survey is instituted with a view of ascertaining the exact condition of every school for the purpose of enforcing, as far as practicable, reforms of abuses that are known to exist in the State, both in large cities where schools are overcrowded and in rural districts where the buildings are old and ill-suited to school purposes. One of the practical benefits that has already been secured by the survey has been that dilatory local Boards have given some attention to the condition of their schools before returning the answers to the questions contained in the circular. Whitewash has appeared on the walls that knew it not before, and broken panes have been restored in dilapidated windows.

"The manner in which the survey is conducted is commendable. The questions propounded are intensely searching, and inquire into every feature and part of the school-buildings and their environments. There are fifty questions in the circular and a chart which enables those compiling the answers to give a definite plan of the school-rooms, the location of stores, sinks, blackboards and windows. The questions are intended to draw out the number of doors in each room, location of windows and size of panes, their distance from the ceiling and their location, whether before or behind the pupil. In the search for sanitary defects, inquiry is made concerning pools of water in the yards; how the building is heated and ventilated; the manner of preventing draughts of wind, positions of the blackboards, source of water-supply, depth of wells and its protection from surface pollution; whether closets are ever flushed, and if there are any dangerous nuisances near the house, such as barn-yards, slaughter-houses or stagnant pools;

whether any provisions are made for hand and face washing, and whether the doors are made to swing outward as the law requires. All the fifty questions are necessary to a proper survey of the buildings."

The results thus secured will be followed up with correspondence and further inquiries until great changes will be wrought in the sanitary fitness of such buildings and appurtenances as are found to be in need of alteration.

As the teaching of hygiene, like most teaching, requires line upon line, precept upon precept, this advantage gained must be followed up by continuous instruction. It has been suggested to us that in every school-room a chart might be placed on the wall with such questions as these as a reminder:

"Is the temperature of this room now between 68 and 70?

"Was this room well flushed with fresh air in the afternoon after the dismissal of the school?

"Is the proportion of carbonic acid in the atmosphere of this room more than 6 parts in 10,000?

"Is the ventilation of this room accomplished without draught upon any pupil?

"Is the light now admitted without injury to any pupil?

"What pupils are compelled to hold their books nearer to their eyes than 15 inches?

"Is this owing to poor print, deficient light, improper desk, or is it a defect in the pupil's eye?"

Such suggestive questions are of service. We are glad to know that the Superintendent of Public Instruction and the various County Superintendents and teachers are now having their attention directed to the teaching of hygiene in the schools. What we desire to have appear in the life care of the people we must have taught to some extent in the schools. The child who is taught the requisites to sustained health and the self-control necessary to secure them has made no unimportant advance in education. Text-books are now at hand which will aid the teacher in doing efficient service in this department. The school circulars of this Board are at the command of all who will send for them.

SANITARY EDUCATION AND INSPECTION BY HEALTH INSPECTORS.

At one time sanitary science and art were regarded as simply incidental to other departments of knowledge. Hence, it was taken for

granted that every physician could give sanitary advice or perform the duties of a sanitary officer. Not only this, but builders, plumbers, architects, engineers, etc., were called upon to advise quite out of the domains of their respective callings. It is true of all these, and especially of medical knowledge, that they lay a good foundation for sanitary acquirements. But it is equally true that sanitary fitness for advice or administration requires special training and the acquirement of knowledge from various departments. It is not until one comes to recognize it as demanding special study and practice that either it or the individual find their proper place.

This has been so far recognized in Great Britain that eleven of its leading colleges, including the Universities of Oxford, Cambridge, Edinboro', Glasgow and Dublin, give special diplomas or degrees as to sanitary or public health qualifications. There are now about 250 of these authorized practitioners in Great Britain and its provinces. Besides this, the Sanitary Institute of Great Britain gives certificates to those who successfully pass the examinations.

The following series of questions are not only valuable as giving an idea of the standard, but may well be studied by all those who desire to test their own sanitary knowledge:

"*Q.* Why ought sewers to be ventilated? What circumstances favor the formation of foul gases in sewers, and how can new sewers be constructed so as to prevent or greatly reduce the formation of such gases?

"*A.* To prevent the foul gases generated in the sewers from finding their way into dwellings, and to prevent any accumulation of such gases in the sewer itself. Bad construction, improper gradients (which allow the sewer to become a sewer of deposit, and not self-cleansing), insufficient flushing where such gradient cannot be obtained, dead ends, want of ventilation, defective joints which may allow of leakage from gas mains to enter sewer, and minor causes. New sewers should be constructed in straight lines from manhole to manhole, with a perfect invert having a uniform fall of sufficient gradient to allow them to be self-cleasing; of such shape as to give the maximum scour with the minimum friction surface; and so ventilated as to make it impossible for sewer gas to generate.

"*Q.* What is meant by disconnecting a house drain? Describe what adjuncts are necessary, and what arrangements shall be made for ventilation.

"*A.* By disconnecting a house drain is meant the severance of the drain from direct communication with the sewer, thereby preventing gases generated in the sewer entering the dwelling connected with it. A siphon trap. A downcast ventilator between the siphon and the premises, and an upcast ventilator at the head (or upper) end of the house drain, to be

carried up its full diameter above the roof of the premises, thus permitting a free current of air to flow entirely through the drain.

"The direct communication between the house drain and the public sewer is thus cut off, and the house drain itself is constantly swept by a current of fresh air entering it at the lower opening, and having its exit. A slight increase in the fall of the house drain just before entering the trap will greatly assist in flushing the trap and preventing obstruction.

"*Q.* Explain the following processes of purifying sewage, and describe the action in each case: (*A*) The lime and one other precipitation process. (*B*) Irrigation of land. How would you lay out the land for an irrigation farm, selecting your own conditions of situation and soil?

"*A.* (*A*) The lime process consists of the admixture of slaked lime (cream of lime) with the sewage, which combining with the solids in suspension causes a heavy deposit to take place in the settlement bank which allows the effluent to discharge comparatively free from offensive matter.

"(*B*) The A. B. C. process as carried out at Leamington, consists of the addition to the sewage of alum, blood, charcoal and clay (hence its name) and I believe some small amount of manganese. This causes a deposit to take place in the shape of a dark colored mud—which may be used as a manure; the supernatant water then passes off to the outfall.

"The irrigation of land may be said to be the treatment of sewage by natural means, or the discharge of it upon land prepared by under-draining for its reception, which allows the sewage to percolate or filter through the soil into the system of underdrains, from whence it is conducted in an almost pure condition to the nearest stream or water-course.

"In laying out a sewage farm my first consideration would be an eligible site, where, by a gentle inclination, I could obtain an outfall for my effluent into a stream or brook. The conditions I should look for in the land would be such a soil as would be not too porous, as gravel, or too heavy, as clay, as the former would allow of too quick a filtration, and the latter to slow, besides being too retentive. I should, therefore, prefer a medium between these two—a good loam overlying gravel, which I should properly underdrain with agricultural pipes, which I should lead to my outfall. I should lay in carriers for distribution of the sewage on the surface of the land, which would be fed from duplicate tanks, and I should provide a storm overflow for excessive rain-falls, snow or floods.

"*Q.* Explain what is meant by 'constant' and 'intermittent' water-supply? What are the advantages and disadvantages of each? What precautions are necessary to prevent the water being polluted inside a house (*A*) with cisterns; (*B*) without cisterns?

"*A.* By the 'constant' system is meant the supply at high pressure at all times of water for domestic or other purposes, and its advantages consist in the fact that it is always fresh, as it does not require to be stored in cisterns, and it is always ready in case of fire. It also requires little or no fittings beyond the ordinary tap. Its defects are the liability to waste,

freezing in the pipes, and the fact that during repairs to the mains the district may be without water, and in some of the higher levels there may occasionally be a shortness of supply; but, even under these conditions, it is infinitely superior to the intermittent.

"The 'intermittent' supply. In this system the water for use must be stored in cisterns or other receptacles, and is liable to interruption by accident or neglect of the company's servants, or the occasion of fire or frosts. Again, the water having to be retained in cisterns, is liable to pollution, the cisterns being very frequently so placed as to be difficult of access for cleansing, liable to the danger of gas emanations, lead-poisoning and fungoid growths; and the fittings required for this system are both costly and intricate.

"To prevent the pollution of water in a house where there are cisterns, it is essential that the cisterns receive a thorough and periodical cleansing; that they be situated in such a position that they be easily accessible for that purpose, safe from the danger of pollution by sewer or other gas, dust or atmospheric influences; they should not be connected with water-closets, a separate cistern being used for that purpose; the overflow or discharge pipe should be led on to an open gulley, and not connected, as is too frequently the case, with the drain. The copper ball-cock should receive attention, as it is frequently found corroded with verdigris; and above all the cistern should be thoroughly ventilated. In a house without cisterns the danger is chiefly from gas escape, and from the fact that often at higher levels the water-supply may fall short, and under these conditions the water-closets would prove a serious nuisance. There is also danger of bursting pipes when the pressure is renewed after a stoppage.

"*Q.* Give a description of an ordinary rain-gauge; mention the points to be observed in fixing it, in order to obtain a correct record of the amount of rain-fall; state the reasons for your opinion?

"*A.* An ordinary rain-gauge is a circular metal cylinder 5 inches in diameter, having an open funnel discharging the rain-fall caught therein into a graduated glass measure (graduated to $\frac{1}{100}$ of an inch). In fixing it, it should be set perfectly level, and permanent, to remain so, never less than 6 inches above ground or more than 12 inches, a mean between the two being general; it should be set upon level ground, at a distance from buildings, shrubs, trees, walls, &c., at the least as many feet from their base as they are high, equal to an angle of 90°. If a clear site is impossible, shelter from N.W., N. and E. is most endurable, less so from the S., S.E. and W., and not at all from the S.W. or N.E.

"Special care should be observed so as to keep all tall growing flowers away from the glasses. Gauge should be emptied at 9 A. M., and the result recorded against the previous day.

"One-twelfth depth of snow equivalent to water.

"*Q.* Describe the systems of ventilation that you would consider efficient for the ventilation of (*A*) a church, (*B*) a dwelling-house.

"*A*. In ventilating a church I should provide a series of protected air inlets near to the roof, above the heads of the congregation in the gallery. The air should pass freely through small perforations, so as to divide it into minute volumes, and below the floor line I would provide protected outlets; the heavy air passing down through the upper openings would mix freely with lighter ascending air, and thus cause a pure current free from draughts. A hot-air apparatus below the body of the church would assist this result.

"In a house I should apply the same principle, placing my ventilators behind the cornice. My calculations I should base thus. An ordinary fire in a grate requires 1,000 cubic feet of fresh air per minute; a gas-burner, 8 cube feet; a human being, 15 cube feet. Thus, a living-room calculated to accommodate ten persons, having a fire-place and two gas-jets, would require, to keep the atmosphere pure, $10\times15=150+8\times2=16+1{,}000=1{,}166$ cube feet per minute; velocity of entering air, 3 feet per second. Openings to the extent of 19.433 feet would supply sufficient air.

"*Q*. In what way does the size and shape of a sewer affect the velocity of the sewage flowing through it? If a 12-inch pipe sewer with an inclination of 1 in 200 gives a velocity of 3½ feet per second, what velocity would it give if laid at an inclination of 1 in 800, the pipe running half full in each case? Would this latter velocity suffice to keep the sewer self-cleansing? To what extent could this velocity be practically increased by flushing?

"*A*. The size and shape of a sewer has a material effect upon the velocity of the sewage flowing through it, an elliptical sewer giving greater velocity of flow to small quantities of sewage than a circular one, as it exposes a smaller surface to be acted upon. In large volume I should prefer circular sewers, as the scour is decreased in proportion to depth; it is, therefore, obvious that a given quantity of sewage would be deeper in an elliptical than in a circular sewer; hence the bottom velocity would be less.

Velocity.

$3.5\sqrt{\frac{200}{800}}=1.75$=not sufficient to make sewer self-cleansing.

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"This head would require to be increased to at least 3 feet per second to render the sewer self-cleansing, although great difference of opinion exists among engineers upon this point, some asserting that a flow of 6 feet is necessary. My own experience is that 3 feet is ample.

"*Q.* A complaint having been made that an offensive smell proceeds from a certain sewer, what steps should be taken to find out the cause; to remedy the same?

"*A.* Offensive smells in sewers being mostly caused by want of ventilation, I should first direct my attention to this point. Secondly, I should see if the sewer was of sufficient inclination to allow it to be self-cleansing. If not, then see if sufficient flushing appliances existed and were efficient. Thirdly, I should ascertain if any structural defects existed, any dead ends, or places where sewer gas either generated or collected.

"To remedy these defects I would construct sufficient ventilating chambers, alter the level of my sewer. This, if not practical, should be provided with sufficient flushing power to give the adequate scour to remove deposit in dead ends. Ventilation should be inserted by commencing the sewer at a manhole fully ventilated.

"*Q.* What precaution should be taken in connecting house drains with sewers in order to prevent foul air from the sewers entering the houses? What kind of connections would you require for water-closets, sinks, &c.?

"*A.* In connecting house drains with main sewers, the drain should be properly trapped and ventilated between the junction with the sewer and the building, and again ventilated at its termination on the premises. These ventilating pipes being equal in diameter to the size of the drain, and carried up to an elevation above the highest point of the roof of building, thus allowing a free current of air to pass through the entire drain.

"All closets, sinks, baths, &c., should discharge into an outside drain pipe (carried up) full diameter above roof into drains; or sinks and baths may be led out on to a gully, properly trapped outside, hence to sewer.

"*Q.* Describe shortly the different methods of applying sewage to land, and in each case explain the conditions under which you would adopt it?

"*A*. 1. Broad irrigation. 2. Downward intermittent filtration combined with irrigation. 3. Precipitation. 4. Deodorization.

"Broad irrigation I would not accept under any consideration, its defects being now so well established.

"Downward intermittent filtration and irrigation is, in my opinion, the best process to obtain an effluent sufficiently pure to be admitted into streams with safety to both health and fish culture; but the system could only be carried out in situations where land could be obtained for the purpose.

"Precipitation is applicable to places where land is difficult to obtain for sewage purposes, and is capable of being carried out on limited areas, without danger or offensiveness, and a fairly pure effluent may be obtained, but it would be better if possible to add the irrigation process before finally allowing the effluent to enter a stream.

"Deodorization may be combined with above.

"Precipitation processes, there are many.

"*Q*. Under what circumstances would you adopt a glazed earthenware pipe sewer in preference to one in brick. How would you form a brick sewer in a running quicksand at a depth of 12 feet.

"*A*. In all cases where the sewer did not exceed 1 foot 6 inches in diameter, and there remained sufficient top soil to protect the pipes from breakage by traffic.

"I would construct my sewer in open close-timbered trench, providing sumps for the collection of the water to be pumped out of the trench. I would provide a subsoil drain below the concrete on which I should construct my invert. Then, as the brickwork proceeded, I should back it up with Portland cement concrete, and continue this by layers until I had the sewer entirely surrounded, as well as over the top.

"*Q*. What is meant by hard water? What sources usually furnish it, and what is meant by total hardness, and by permanent hardness?

"*A*. Hard water is understood to mean a water which destroys much soap arising from the formation of insoluble salts by the combination of the fatty acids of the soap with the lime and magnesia present in the water; and it is not until these mineral salts have become exhausted that a lather can be produced. This hardness arises from the presence of dissolved matters, including mineral salts, organic substances, and carbonic anhydride.

"Hard water is mostly derived from deep wells—especially in the limestone, new red sandstone, or chalk formation.

"Total hardness—the temporary and permanent hardness combined.

"Temporary hardness is that which is freed by boiling the water, and permanent hardness is that which remains after boiling.

"Hard water may be softened by adding lime as a filtering medium or as milk of lime mixed with the water and then allowed to settle. Softening by boiling resembles softening by lime as in Clarke's process.

"*Q*. What are the most common causes of pollution of water in wells, in water-butts, and in cisterns inside houses, and what steps would you take to prevent the pollution in each case?

"*A*. *Wells.*—The pollution of well-water is mainly caused by the infiltration of polluting matter into the well, from leakage, from drains, cesspools, cesspits, and land dressings; the rain-fall upon the latter soaking through the land finds its way into the well—often through insufficiency in depth, bad construction, and improperly situated site—the well being frequently found adjacent to stables, cow-sheds, and faulty surface drains.

"*Water-butts.*—Foul air and gases, due to want of proper ventilation, and the stagnant nature of the water; animalculæ, fungoid growths, and filth from want of attention, often caused by the inaccessibility of the water-butt for cleansing purposes.

"*Cisterns.*—The improper position in which many cisterns are placed, the fact that the cistern is often in direct communication by means of the waste pipe with the soil pipe or closet-pan, metallic (lead) poisoning, dirt and accumulation of dust through the position of cistern being, in many cases under the flooring, impossible or at least difficult of access.

"*Wells.*—The remedy I would suggest is to construct the well of such materials as to be impervious to leakage, either internal or external; to carry down the bore until a natural and undoubtedly pure supply is tapped; protect the well from earth or foreign matter being cast into it. Give perfect ventilation and adequate means of cleansing.

"*Water-butts.*—Place water-butts in such a situation that they may be easily accessible to cleansing, in such a position that they may have the influence of light and air, fit them with properly ventilated covers, and frequently cleanse them.

"*Cisterns.*—Place them in easily accessible places for cleansing and inspection—free from dust-gas or smoke—provide separate cisterns for flushing purposes to water-closets, by no means allowing the cistern used for domestic water to in any way be connected with drains or water-closets, the waste or overflow tell-tale being led into the open; all cisterns to be properly covered in and ventilated.

"*Q*. Draw up a short set of by-laws for a common lodging-house.

"*A*. No greater number of lodgers shall at any time be admitted than authorized by the sanitary authority, the local authority having power to vary the number to be admitted under certain conditions. Sanitary provisions: All yards, areas, fore-courts, &c., to be kept thoroughly clean and efficiently drained; all rooms, passages, halls and staircases to be swept daily and thoroughly cleansed with water and soap twice a week, or oftener if required by the local authority or its officers; all windows, doors, wood, stone or metal fixtures to be thoroughly cleansed as often as requisite; all bedsteads, bedding and bed-clothing to be kept thoroughly clean; all chamber and other vessels to be emptied and cleansed before 10 A. M. daily. Provision in plenty to be made of all basins, jugs, towels and chamber receptacles. Provide requisite water-closet accommodation, and keep

same in good working order, thoroughly clean, and well ventilated; also ash-pits. All windows shall be opened daily at 10 A. M., weather permitting; beds and bed linen thoroughly exposed to atmospheric influences. All cases of illness or death to be at once reported to the local authority and medical officer of health. A copy of the local authority's by-laws and license to be exhibited in a conspicuous part of the premises; and the local authority, medical officer of health, surveyor, sanitary inspector, or any of the local officials, shall have free admittance at any hour, either by day or night. Criminals or noted bad characters shall not at any time be admitted under penalty of loss of license.

"*Q.* Describe in what manner you would construct a macadamized road upon a newly filled up ground. Give sketches of the construction of a macadamized road, and show the form of the surface and falls from the crown to the channel.

"*A.* I would first of all shape the ground to the same contour as the proposed finished surface, then thoroughly roll it with a heavy roller, if very treacherous; I should then well bush it (if wet or spongy, I should in addition cross drain it with agricultural pipes), then roll the bushes, then spread my layers of hard core, brick rubbish or chalk, which I would have broken to a 3 inches gauge, then again roll, then I would provide for a 3 inches coating of good, sound, clean gravel (the 3 inches thickness to be well rolled in), well watered and rolled to complete consolidation, finally watered and finished with a 3-inch or 4-inch coating of macadam, broken to a 2½-inch gauge, watered and rolled to consolidation, the finished surface having a fall of ½ inch to a foot from crown to channel.

"N. B.—I, of course, assume the sewer is laid in and gulleys connected, otherwise the sewage or drainage is the first consideration, the gulleys being the data for the finished surface of road.

"*Q.* What volume of sewage would you provide for at the outfall sewer, from a town of 10,000 population, the drainage area being 550 acres, taking 25 gallons per head of water-supply, and ½ inch rain-fall in 24 hours?

"*A.* 2,471,053 gallons.

"Half an inch rain-fall equalling 11.200 gallons or 50 tons per acre.

"*Q.* In what way does the size and shape of a sewer affect the velocity of the sewage flowing through it? If a 12-inch pipe sewer with an inclination of 1 in 175 gives a velocity 3½ feet per second, what velocity would it give if laid at an inclination of 1 in 800 (the pipe running half full in each case), and would this latter velocity suffice to keep the sewer clear of deposit? To what extent could this velocity be practically increased by flushing?

"*A.* The size and shape of sewers have a material effect upon the velocity of the sewage flowing through them—elliptical sewers giving greater velocity of flow than circular ones—exposing as they do smaller surfaces to be acted upon by the sewage flowing through them. But where there is large volume I should prefer a circular sewer, the scour being decreased in propor-

tion to the depth of the liquid; it is obvious, therefore, that a given quantity of sewage would be deeper in an elliptical than in a circular sewer, and the down scour of bottom water decreasing with the depth.

"The velocity of flow in a sewer running half full at an inclination of 1 in 800, being 1 ft. 9 in. per second, would, in my opinion, be insufficient to keep the same free from deposit, but by increasing the head of water so as to give a flow of 3 ft. per second, the sewer should be free from deposit, provided always that the sewer is properly constructed.

"*Q.* In providing a water-supply to a town what are the chief points to which you would direct your attention if the supply is to be from (*A*) wells; (*B*) streams?

"*A.* (*A*) From wells, the geological situation of the towns surrounding, with a view to ascertain its probability of affording a sufficient supply, and its position as to gravitation, as to likelihood of being hard or soft water, and its purity.

(*B*) From streams, the purity and sufficiency of supply, the amount of water that might be extracted from the river without interference with vested interests, its position as to utilization as a motor in case of pumping operations, if acted upon by tidal influences, and its liability to fail in supply in drought.

"*Q.* What are the most important points to be considered in examining the ventilation of a room? How much cubic space would you require per head in (*A*) sleeping-room; (*B*) in a sleeping and living-room?

"*A.* I would ascertain whether the window space was sufficient, and if made to open top and bottom; if a fire-place and chimney, with flue open to sky; height of room, its dryness or otherwise, and the amount of gas (if any) likely to be consumed in the rooms.

"The amount of space per head in (*A*), not less than 300 cubic feet; in (*B*), not less than 400 cubic feet; but I should prefer a much larger quantity, Professor Huxley's formulæ being 600 to 800 feet.

"Half the above quantity for children under 10 years.

"*Q.* What is meant by a gathering ground? Describe the conditions which have to be observed in selecting a gathering ground for the water-supply of a town. Upon what data would you base your calculations for providing a sufficient supply in all seasons?

"*A.* A 'gathering ground' is land that falls or drains into a river or stream; in fact, the water-shed, forming the source of supply to the stream, and is generally situated between the contour line of hills, by which it is often nearly surrounded.

"That the source of supply is pure, ample and not unduly hard; that there exist means, natural, if possible, or, if not, reasonable prospects of being able to impound the water, including rain-fall in winter for use in the dry season. I should carefully examine the soil to discover any fault or defect, that if the water were impounded it did not escape. I would

also carefully examine for such a site as would allow the water from the reservoir to gravitate to the town.

"Taking forty gallons per head per day of population, I would allow for four months' consumption as storage water.

"*Q.* State the chief differences between river water and water derived from shallow wells and deep wells.

"*A.* River water being largely mixed with rain-fall and deriving a percentage from land drainage is generally soft, but may not be sufficiently pure for domestic use without mechanical filtration.

"In shallow wells the water is also sometimes soft, being chiefly derived from land drainage and rain-fall filtering through the land.

"In deep wells the water is generally very hard, and requires to be softened ere it is used, but it is also generally pure.

"*Q.* What is meant by the separate system of sewerage? In what circumstances would you advise its adoption?

"*A.* The separate system of sewerage means the separation of the sewage proper from surface drainage or storm water.

"The cases in which I would adopt it are: In towns that are subject to heavy floods, rain-falls, or in marsh lands, where leakages might occur.

"*Q.* What rules should be adhered to in regard to gradients, manholes, lampholes and ventilators, and flushing in a sewerage system?

"*A.* The following rules should apply to gradients: Should be such as will allow the sewer to be self-cleansing, and no greater (if avoidable) as too heavy a gradient has a wearing effect upon the sewer and in some cases at the intersection of sewers or gradients may cause an obstruction and possibly in floods a burst.

"Manholes should be constructed at all alterations of gradient or direction, or at intersection, or at any point where it would be advisable to provide for flushing.

"*Q.* State some of the rules which should govern the question of sewage disposal at the outfall.

"*A.* That the effluent discharged from the sewer outfall should be non-polluting, and the following liquids should be inadmissible into *any stream*:

"1. Any liquid containing in *suspension* more than 3 parts by weight of dry mineral matter, or 1 part by weight of dry organic matter in 100,000 parts by weight of liquid.

"2. Any liquid containing in *solution* more than 2 parts by weight of *organic carbon*, or .3 parts by weight of organic nitrogen in 100,000 parts by weight of liquid.

"3. Any liquid which shall exhibit by daylight a distinct color when a stratum of it one inch deep is placed in a white porcelain or earthenware vessel.

"4. Any liquid which contains in *solution* in 100,000 parts by weight more than 2 parts by weight of any metal, except calcium, magnesium, potassium and sodium.

"5. Any liquid which in 100,000 parts by weight contains whether in *suspension* or *solution*, in chemical combination or otherwise, more than .05 part by weight of metallic arsenic.

"6. Any liquid which, after acidification with sulphuric acid, contains in 100,000 parts by weight more than one part by weight of free chlorine.

"7. Any liquid which contains in 100,000 parts by weight more than one part by weight of sulphur, in the condition of either sulphuretted or of a soluble sulphuret.

"8. Any liquid possessing an acidity greater than that which is produced by adding two parts by weight of real muriatic acid to 1,000 parts by weight of distilled water.

"9. Any liquid possessing an alkalinity greater than that produced by adding one part by weight of dry caustic soda to 1,000 parts by weight of distilled water.

"*Q.* Describe the conditions which have to be observed in selecting a 'gathering ground' for the water-supply of a town. Upon what data would you base your calculations for a sufficient supply in all seasons?

"*A.* In selecting a gathering ground I should first direct my attention to the streams situate within its area, and observe and test their amount of supply. Next direct my attention to the position of any mills or other water-rights that might be interfered with by abstraction of water therefrom. Then to the facility of impounding, and the position of the site with regard to gravitation. I should then examiue for the average amount of rain-fall that could be relied upon, and above all examine for the purity of the supply.

"I should base my calculations upon a supply of 40 gallons per head per day, allowing for double the present population, and impound for a four months' supply, irrespective of any rain-fall.

$$\text{40 gallons}\begin{cases}\text{25 gallons domestic supply.}\\ \text{10 gallons manufacturing.}\\ \text{5 gallons water and fire contingencies.}\end{cases}$$

Mains under constant fire pressure.

"*Q.* State some of the most common ways in which water is polluted (*A*) before collection; (*B*) after collection and in the process of delivery to the houses; (*C*) after delivery to the houses. Describe the best means of preventing such pollution in each case.

"*A.* The pollution of water before collection arises from many causes, some of which consist in the discharge of sewers, manufacturing processes, and often from highly manured areas, which, during heavy rain-falls, carry quantities of diluted manure into the streams; also road drains, which during storms bring down large quantities of impurities. Insufficient filtrating, atmospheric influences, gas leakages, defective joints in the mains, and many minor causes.

"By defective sanitary arrangements in the houses.

"To ascertain that the source of supply is undoubtedly pure and beyond such influences.

"To provide sufficient filtering area by using covered reservoirs properly aerated.

"*Q.* Describe the precautions necessary to prevent damp in buildings.

"*A.* The whole site (if wet) to be underdrained, then concreted, the walls to have a ventilated damp-proof course all round, and free circulation of air between the concrete flooring and the wooden flooring of room above, light and air being deadly enemies to damp.

"*Q.* Give a description of the process termed intermittent downward filtration. State what area of land you would require with a gravelly soil for applying this method of purifying sewage to a town with a population of 20,000 inhabitants; and state the arrangements you would adopt for dealing with the rain-water falling on the roofs, yards and streets.

"*A.* Intermittent downward filtration may be termed a natural system of purification of sewage by means of the filtering and aerating action of the soil; it is carried on by discharging (with or without previous precipitation) upon a properly prepared area, the sewage of the town under drainage. This sewage is conducted upon the prepared area by a series of carriers, and then allowed to filter through the land into drains laid about 6 feet under ground, from whence it (as an effluent) is conducted to its outfall, mostly a river. The action upon the sewage is threefold—viz., evaporation, aeration, and filtration, and if properly conducted should give an effluent of a very high standard. As to the amount of land requisite for the purification of the sewage of a town of 20,000 population, authorities differ, but taking the daily amount of sewage per head at 50 gallons, and the average of five persons to each house equal to 250 gallons per house per day, then the fact that this quantity must be got rid of in about eight hours, it would not be safe to reckon less than 1,000 gallons per house. Then taking 4,000 houses, there would be 4,000,000 gallons of sewage to deal with, which could be successfully treated on 5 acres of such land; but it would, of course, require that a very far larger amount should be provided, as no land could be expected to be constantly under treatment, and the least amount should be five times this quantity, so as to have only one-fifth under treatment. Great diversity of opinion exists upon this subject, and no very hard and fast line can be drawn. Each case must rest upon individual merits and local circumstances. With regard to dealing with rain-water from roofs, most of it should undoubtedly be stored for domestic use, as it is far too valuable to be uselessly wasted. Drainage from yards and roads should be conducted in separate channels (from the sewer proper) to a natural outfall; although often in storms the washings from roads may be nearly as bad as sewage; but, on the other hand, if the surface-water were admitted, the sewers would have to be greatly increased in size to provide for excessive rainfall.

"*Q.* In arranging the water-supply for a manufacturing town of 30,000 inhabitants, state what you consider of importance as to: (*A*) Sources of supply; (*B*) Quantity required; (*C*) Distribution.

"*A.* (*A*) The geographical situation of the town, as to the possibility of gravitation from rivers or otherwise; the geological situation of its surroundings, with a view to its probability of affording a sufficiency of supply and its nature as to hardness, &c.; the annual average annual rain-fall; what water rights, if any, existed; the present population and prospective rate of increase, and whether the town was a full w.c. one or otherwise. (*B*) Twenty-five to thirty gallons per head population. (*C*) Under pressure that all cisterns had ball-cocks and tell-tale overflows; that Deacon's waste-water preventers were in use; that a thorough system of inspection existed to detect waste; that the mains were well laid and efficiently jointed, and that a sufficiency existed for immediate use in case of fire. In the constant service system there is very little, if any, waste—the returns from many towns showing none; but in the intermittent there is often a large amount of waste through neglect of the inhabitants and defective fittings. The screw-down tap somewhat modifies this, but it is a very slow and unsatisfactory way of drawing water.

"*Q.* In what ways is water liable to be polluted after collection, during its distribution to houses, and in houses? What means would you adopt to prevent such pollution?

"*A.* Water may become polluted after collection by fungoid growths and atmospheric influences (where exposed to such); during distribution, from imperfect pipes and joints allowing sewer or other gas to enter the mains; in houses, by improper fittings, such as a cistern in direct communication with the drain, or so placed as to be difficult of cleansing, and frequently not ventilated, and other minor causes."

HEALTH INSPECTORS.

Boards of Health have in very many cases come to realize that their greatest need is competent Inspectors. When such are found there is now more tendency properly to remunerate them. The Inspector needs to be a person that recognizes that much will depend upon courteous mode of inquiry, and a disposition to aid those who are found to have nuisances in getting rid of them. While sometimes there is need of great plainness of speech, a mild and respectful firmness is usually the most successful. But the Inspector must know the law, and also must know much as to sanitary matters. Unless he cannot only discern odors, but know how to advise as to the modes of preventing nuisances, he will be only partially successful. It is

for this reason that this Board has recently given special attention to informing local Inspectors as to their duties, as well as afforded them opportunity to acquire more of the requisite knowledge. On them, more than anyone else, depends the efficiency of health administration, and, consequently, the sanitary progress of the State.

BOARD OF HEALTH LIBRARY.

This Board early gave attention to the accumulation of such a library as would be of essential service to the sanitarians of the State. By reference to the Fifth Report (1881) there will be found a catalogue which furnishes a list of books in possession up to that time. It had been the intention of the Board to re-catalogue with the additions up to the present year. But as next year a change and re-arrangement of books will be more convenient, in the removal to enlarged quarters, it is deferred to that time. But the library is open to the use of all persons. Books are sent to members of Health Boards by mail, for use for two weeks, if they pay the postage or expressage. Thus, Inspectors, or those investigating any particular subject, can avail themselves of the best authorities. It is also our desire to place full files of the State Report, as far as possible, in all the public libraries of the State. If informed as to these we shall be glad, as far as possible, to supply copies.

NEW JERSEY SANITARY ASSOCIATION.

The New Jersey Sanitary Association continues to lend efficient aid to the sanitary information of our citizens. It commands the attendance of those well known as informed in various departments bearing on public and general sanitation. Members of Boards of Health and Health Inspectors find it a center of information as to the details of their work. The last session was held at Trenton, and fully occupied two days. By an arrangement, a portion of the time was given to papers and specific instruction to local Boards. Thus, this Board was able to secure several valuable lectures of direct instruction to our health officers. It is very important that all health officers improve this opportunity to obtain valuable assistance in their work. It is very noticeable that those who are recognized as the most efficient officers of local Boards are seldom absent. If so, it is safe to infer

that those of less experience or acquirement cannot afford to neglect so ready a method of availing themselves of the experience of others.

THE POTTERSVILLE SICKNESS.

In June last over 200 of the citizens of Pottersville, a small village on the border of Hunterdon county, were taken seriously ill. All of them had attended a church festival the evening previous, and all those taken ill had eaten of ice cream. As none was left over and no sickness occurred until several hours afterward, no satisfactory analysis could be made. The little dish-water that was left was examined, but nothing suspicious found. Twelve days after, one of the sick persons died. A chemical examination, made by Professors Austen and Wilbur, of Rutgers College, resulted in finding a minute quantity of arsenious acid. The report was as follows:

"Total weight of liver tested..................................5.09 oz.
Total weight of arsenic found...............................0.00462 grains.
Total weight of kidney tested...............................3.53 oz.
Amount of arsenic obtained too slight to weigh, but sufficient to show characteristic properties."

The amount of arsenic was so very small as to suggest the possibility of its being innocently contained in bismuth, or some other medicine. The cases of sickness have been extensively commented upon, and the possibility of some poisonous substance having been developed in the milk has been much discussed. It is known that from time to time there have been serious effects from the eating of cheese. So certain forms of cheese, producing such results, has come to be known as "sick" cheese. In July, 1885, Prof. Vaughan, of Michigan, of Michigan University, reported to the Board of Health of that State that he had discovered the poison, which is described as follows:

"It is a product of slight putrefaction in the cheese which probably occurs in the vat, as the curd has been known to poison a person. By this slight putrefaction, or excessive fermentation, as it may be called, a large amount of *butyric* acid is formed, and this in the presence of the caseine of the cheese is capable of developing a poison. Different samples of poisonous cheese contain different amounts of the poison. The same weight of cheese from one cake furnished three times as

much poison as that from another cake. The poison was obtained in long needle-shaped crystals, which are freely soluble in water, chloroform, alcohol and ether. The smallest visible fragment of a crystal placed upon the end of the tongue causes a sharp stinging pain at the point of application, and in a few minutes dryness and constriction of the throat. A slightly larger amount produced nausea, vomiting and diarrhœa."

The poison is volatile at the temperature of boiling water, and for this reason even poisonous cheese may be eaten with impunity after being cooked. Prof. Vaughan called this alkaloid tyrotoxicon. Since that time the same chemist has found tyroxicon in a specimen of ice cream that caused serious sickness in eighteen cases, as also in specimens of good milk which had been kept under observation by him for several weeks. He speaks of it as a poison produced by fermentation and as "a ptomaine in all probability due either directly or indirectly to the growth of some micro-organism." As he has not yet obtained enough to make an ultimate analysis or for other tests, we must await other developments. Long since, Lauder Brunton, M.D., of London, commented on the action of butyric acid as a nerve poison, and referred to the investigations of Otto Weber (1864) and Senator. This acid is very frequently present in the decompositions of milk. It acts directly on the nerve centers. It may exist in the milk before use or may be formed afterward. Speaking of it in another article, Dr. Brunton says: "It must not be forgotten that a man may be poisoned by substances formed in his own intestines as well as by poisons taken into them by the mouth." From some cause or other, it is certain that accidents or sicknesses are occurring too frequently from the use of frozen milk. It is so important and refreshing a food that more care needs to be exercised in its preparation. Sometimes the vanilla or other flavoring used is believed to have caused the sickness. In other cases it has been traced to the gelatine which some use freely in preparing it. It is too often a very composite compound. If the milk is inferior or impure or stale, the freezing does not rectify it. In the case in hand, each family contributing prepared its own portion. So some had corn starch in it and some not. The milk was not merely of the usual mixture but of very different constituency. While much obscurity hangs about this particular case, it is well that it should serve as a caution as to careless or unguarded mixtures of whole milk, raw milk, cooked milk, gelatine, corn-starch milk or other compounds sold as ice cream.

THE LONG BRANCH MILK SICKNESS.

Early in August last a number of cases of milk sickness occurred at a hotel at Long Branch, which were fully investigated by Inspectors and Analysts of this Board. Dr. W. K. Newton made a thorough inquiry into all of the circumstances and procured samples of the milk. Chemical examination by S. Wallace and himself revealed the presence of the poisonous crystals of tyrotoxicon, as in the cases reported by Prof. Vaughan. It transpired that the morning's milk, from the same cows, did not contain the poison. It was found only in the milk that had been drawn at noon and then quickly placed in cans and brought to the hotel. The Inspectors believe that this abnormal fermentation occurred because the milk had not been cooled, and while warm from the animal heat of the cows had been transported and so shaken up in close cans. As this is the first case of the finding of the crystals of tyrotoxicon in *new milk*, it will be well to subject other samples to similar transportation and find whether similar results are found. The use of milk is so necessary and indispensable that it is very important to guard every method of preserving its natural constituency or securing only its normal changes. It has long been known that its changes are peculiar and varied and that its powers of absorption are great. Its powers for evil as well as for good need to be accurately known and defined. It is found that the boiling of milk protects it from these changes. So it is often wise, especially in summer, to rely on boiled milk where its source and care can not be known.

DISEASES OF ANIMALS AS RELATED TO HUMAN HEALTH.

It is well that attention is being more directed to animals and animal diseases as related to the public health. We need to know what animal diseases can be communicated to mankind and under what circumstances either their meat or milk is unfit for food. It is now pretty certain that tuberculosis in animals is of the same nature as some forms of consumption in man. There are good authorities that believe that the milk of tuberculous cows fed in its raw state to infants will cause marasmus or some forms of wasting disease. It is certain that typhoid fever and scarlet fever have been conveyed by milk. It is probable that the same is true of erysipelas and diphtheria. Foot

and mouth disease and some forms of apthæ are no doubt directly communicable. More recent investigations made by Mr. Power and others under the direction of the Local Government Board of Great Britain seem to indicate that scarlet fever has an animal origin. There is much reason to believe that boils and forms of skin disease are excited by poor or diseased meat. Dr. Vacher, the health officer of Birkenhead, in his excellent article on foods in the *Sanitary Record* (1885), enumerates 17 diseases of animals that render a part or the whole of the carcass unfit for food. By proper abattoirs and Inspectors at them, it is possible to protect our markets from diseased meat. Newark and some other cities have Market Inspectors. But the meat and viscera of animals should also be seen at the time of slaughter. The attention of city authorities especially needs to be directed to this subject, and especially in the interest of the working classes, who are more likely to be imposed upon by second-rate meat.

Veterinarians and others who are concerned in watching the food-supply are aware that there is a great increase in the amount of poor meat that is offered for sale.

BOVINE SCARLATINA.

The fact of the conveyance of typhoid fever, diphtheria and scarlatina through milk supplies has for some time been recognized.

In some cases it has been conveyed to the milk by the addition of water. In other cases the milk itself seems to have been the absorbent of particles that have conveyed the disease. A new series of facts now seem to intimate that either the disease of scarlet fever is derived sometimes from the cow, or can be transmitted to and through the bovine species. In November, 1885, an outbreak of this fever occurred in Hendon, in England, that led to an investigation by the Local Government Board. The investigation has been conducted by Dr. W. H. Power and Dr. Kline with their usual precision. For details we must refer to Dr. Power's report. It seems to establish the relation of cause and effect between the disease as found on the teats and elsewhere in the cows and that which was recognized as scarlatina by the medical attendants, in the many cases which were traced to this source, in Hendon and London. Whether the scarlatina as here found is the human form of a bovine disease, as Mr. Blythe seems to infer, or whether it is merely shown that the cow contracts the disease and that thus it may be retransmitted to the human organism is not clear.

Dr. Kline's experiments appear to confirm the identity of the bovi and the human disease in these cases. At any rate these facts a similar ones that have transpired as to the relations of human a animal diseases open up a most hopeful line of inquiry. We may n only find the similarity or identity of some of the communical diseases of men and animals, but be able to attenuate them in th transmission so as to secure the material for prophylaxis.

THE DISPOSAL OF HOUSE-SEWAGE IN DISTRICTS NOT PROVIDED WITH SEWERS.

BY C. P. BASSETT, C.E.E.M., OF NEWARK, N. J.

It requires no little assumption to venture upon the well-furrowed soil surrounding the subjects of domestic wastes and their disposition. Increasingly hazardous is this step when approaching those familiar with many of the methods applied or suggested as salutary or remedial. This difficulty is none the less acute, that potent facts bearing on the subject are very generally disregarded, and warnings and advices grown old by repetition. are standing at the door of public opinion waiting patiently for recognition. It is not so much that we need more or even that we need better methods than are at hand, but that present knowledge be, in some measure, recognized and applied.

It is not my purpose to enlarge on the necessity for complete and efficient removal of house-sewage from the vicinity of dwellings; so much, at least, can be taken for granted.

The present statements must be concentrated on the means and methods for safely disposing of such wastes. It would not, however, be inappropriate at this stage of the subject to consider the character of these wastes. It is not possible, much less necessary, to enumerate the matters which combine to make up house-sewage; but a suggestion will be all that is needed to secure proper recognition here of their complexity and troublesome qualities.

Human excrement, which may be the medium for transmitting distinct disease germs; washings from the bath and laundry, which may be equally dangerous; and the multiform organic wastes of the kitchen and pantry are the main elements requiring consideration. Juicy steaks, poultry, pastry, broth or other rich food when it appears upon the table, has reached a point from which we may profitably observe the rapid changes in its form, disintegration and decomposition. The resulting sewage is usually offensive in proportion to the

original richness of the food. It is not within the limits of this paper to discuss or trace these interesting changes, but in considering the matter, it should not be forgotten that the refuse from the table and the kitchen sink may become as dangerous sewage as that which flows from the water-closet.

It would be interesting at this point to turn aside to consider what are the dangerous qualities of decomposing matter, their scope and limitations, how they enter into or affect the human system; but the microscopical or physiological phase of the question cannot now receive attention. Admitting the need of rendering harmless, or of removing beyond their dangerous influences the organic wastes incident to human existence, as soon as they are produced, we have left for consideration the varied conditions in different stages of civilization, and the complex problems which they produce, with the processes available for solution of the difficulties.

The question of health is certainly pre-eminent in this consideration. It should be followed closely, however, by economy, in order that the hygienic results desired may be most widely distributed and effective.

As we glance over the settled portions of the State, we are astonished that a subject confessedly of so much importance has received so little practical treatment. Health Boards and associations have sounded alarms; facts and information showing the needs and benefits of action have been gathered and distributed; in some cases, committees have been appointed to collect added information or remove flagrant evils; in some sections, real progress has lately been made, but in the main, the rut in " which our fathers trod," has been made to serve later and more crowded travel. In the midst of this careless indifference, the situation becomes more threatening, and death-rates are creeping up in some localities.

If the hidden indecencies in many of the towns of the State were revealed in conjunction with those readily apparent, they would present a truly sickening picture. There is not a town in the State—and I make the statement after acquaintance with the facts—where the house-sewerage is properly removed from even a majority of the houses in the closely inhabited districts. If I am doubted in this assertion, let me ask you to step to the rear of any buildings in the older and closely built up portions of any city in this State, and make careful examination of your surroundings. One picture describes them

all. Besides the complex forms of filth upon the surface, you will find wells, cesspools, privy vaults and rubbish heaps dotted about the scene in sickening proximity. Should you not be accustomed to crucial examinations of these details, and should you choose a warm, moist day for your investigations, you may not be ready to pursue them further. But assuming you to be less fortunate, you will acquaint yourself with the number and character of house connections with the sewer, should there be one in the street. It is hoped that you may see some house-drains torn up for repairs, and be able to examine the plumbing systems of the houses. Do this, and I am certain of your verdict. There is no need to confine your investigations to the poorer sections; wealth offers but slight barrier to sanitary recklessness. There are, in the towns of the entire State, only about a dozen sewerage systems, and several of these are in miserable condition. In its application therefore to the needs of the State, the subject in hand should receive general and comprehensive treatment. In analyzing the subject two main divisions appear. 1st. Districts, unprovided with sewers, where such lack can be wisely replaced by other appliances. 2d. Districts, unprovided with sewers, for which the suggestion of any other remedy than a properly equipped sewerage system would be idle.

Main attention will be given to the first of these divisions. For the purposes of the present paper, the methods employed for the removal or disposal of house-sewage may be grouped under heads as follows: 1st. Cesspools and privy vaults. 2d. The pail or tub system. 3d. Dry earth closets. 4th. The sub-irrigation system, for use at or near the site of the production of the wastes. 5th. Removal through sewers, usually by water carriage, with the varied forms of disposal after general collection. While all these processes do not serve the same purposes, they are designed for a common object and merit consideration.

No condemnation can be too sweeping to properly characterize the privy vault and cesspool as generally constructed. It is astonishing that their use should have been so long tolerated. Air, soil and water are contaminated by their putrefying contents. They are built close to dwellings, that removal of the wastes as they are produced may not be necessary; they are built with porous sides and bottom, that frequent removal of the putrefying mass may be avoided. The process is an outgrowth of laziness and stupid efforts at economy. It

has been continued mainly under the spur of the same incentives, until now custom has developed so stringent a law that it seems almost impossible to secure the abolition of this intolerable nuisance. When the character of the soil allows the liquids to freely soak away, cesspools and vaults are at a premium, and the fact is counted as an inducement to the locality. In the midst of a dense population this is scandalous. Recent light thrown upon the purification of sewage in the soil makes more apparent the evils of this process. It is known that the purification is largely the result of fermentation, or the life process of certain very minute germs or organisms which sweep away the filth with remarkable vigor and speed. It is further known that these organisms are not usually found more than 18 inches below the surface of the ground. The danger of pouring concentrated filth deep into the earth, as is done through the vault and cesspool system, thus becomes apparent. Up to the present time the active agitation of the sewerage question in any community has been ample evidence that the adjacent streams were laden to their limit with filth, or that the subsoil was saturated with sewage to a point where the economical use of the cesspool had ceased. This compulsory decency does not deserve the name of sanitation.

The evident necessity for some improvement in the leaching vault has produced the modern privy, extensively used throughout England. In this later form the vault is impervious; it is intentionally contracted to a small space beneath the seat, in order that its contents may be frequently removed; some arrangement for scattering cheap deodorizing materials on the excreta is secured; the seat is hinged, in order that it may be raised, and a ventilating shaft is provided. As much as possible of the interior of the building should be made impervious.

A further perfection of this idea is obtained by replacing the vault with a movable tub or pail. This constitutes the "tub" or "pail" system. In both of these processes it is proposed to have the contents removed at frequent intervals, varying from three or four days to two weeks, by regular collectors in the service of the town. Kitchen wastes may be removed in this manner. In Rochdale and Birmingham, England, the "pail" system has reached its perfection. In Birmingham in particular it has reached enormous proportions; more than 40,000 pails, representing over 250,000 people, are collected weekly, and carried in specially constructed wagons to the dumping station. Pails empty and clean are put in their place. At the station

the contents are placed in a tank, treated with sulphuric acid to fix the ammonia, dried and bagged for sale. The heat for drying is largely obtained by burning cinders and garbage collected in the town. This removal at Birmingham is in *addition* to a complete system of sewers, and one of the largest sewage purification works in the world. The net cost to the authorities at Rochdale (a city of 70,000) of removal by the "pail" system is less than ten cents a head per year. While it is not felt that this system would be tolerated in this country, in cities of large size, for general use, it is certain that its adoption in many towns of small size would be an immeasurable improvement over the privy-vault system, and in many cases would be actually economical if carried out with proper regulation. In towns not provided with sewers or public water-supply, the introduction of this system is strongly commended. Under these conditions it supplies the only weapon available to crush out the privy-vault system.

To clean and fill existing vaults and alter the buildings into tub or pail closets, would be easy and inexpensive. A system of distribution and collection is an essential; it may be readily established and managed. The results will amply repay the effort.

Another method of removal which has met with success under certain conditions, is the "dry earth closet." Urine and fæces fall into the closet, and fine, dry earth is added after each deposit, either by the operation of a mechanism delivering a uniform quantity, or by hand. When proper earth is used the excretal matters are deodorized and decomposed. The compost may be removed at pleasure and used as manure. This system cannot secure wide popularity. It may be well in isolated cases, but could never be relied on for the work of a town filled with ignorant or careless persons. A proper supply of earth, dried and fine, prompt covering the deposit, removal of the compost, and ventilation of the closet, are among the requisites difficult of procurement. The "ash closet" and the "charcoal closet" are names which have been used to distinguish the absorbent material used; in design the closets are practically the same. These systems of "interceptions," as they are termed, are known in this country almost entirely through descriptions of European systems and by the personal investigations of specialists, yet it seems unnecessary to describe their details here. The disadvantages of all such systems may be summarized: 1st. They store excreta and dangerous wastes about the premises. 2d. They do not provide for large quantities of liquid.

3d. They are of some inconvenience and trouble. Their apparent advantages are: 1st. An incalculable improvement over the leaching vault. 2d. Economical removal of the wastes. 3d. They act as conservators of manurial elements. 4th. It is possible to thoroughly disinfect the alvine discharges in time of epidemic. Finally, the "tub" system can be strongly recommended for small towns during their periods of growth prior to the introduction of water-supply and sewerage. In this country we should probably not allow its development to such a size as in Birmingham for a population of a quarter of a million. The system must be controlled by the town authorities and the removal of filth made compulsory. It seems needless to continue the system after the introduction of a sewerage system, although it unquestionably intercepts much dangerous filth.

Upon the introduction of a public water-supply, the difficulties become more complex. A large and constant stream of water is distributed through the houses, is laden with filth, and an outlet for it must be provided. Under the present regime this outlet is arranged to be into the soil. With a more complete recognition of the evils of the cesspool and vault system this will cease. General concerted action for the removal of house-sewage will then be introduced.

A process, laterly well received and widely introduced in this State, aims at the solution of parts of the problem under these conditions. The "sub-irrigation" system has met with a success which merits attention. The origin and growth of this system is too well known to need comment here. Through small, open-jointed tiles, placed from eight inches to one foot below the surface of the ground, the house-sewage is flushed from an automatic siphon tank into which it runs as it is generated after interception of the solids in a settling tank. The elements which experience has shown to need close attention are: Proper adjustment of the grades to the capacity of the distributing pipes; care with the joints; need of wider drains in all but exceptional cases; complete interception of solids. Recent knowledge, previously referred to, of how purification takes place in the soil argues strongly against a depth of distributing pipes which has in some cases been adopted. They should not be more than one foot beneath the surface. The system should be limited in its proximity to houses and to lawns free from shade. Its use must of necessity be confined to the well-to-do classes, and preferably to those who are willing to give some attention to its working. The danger is, that it will be used by those who insist on decency about their homes, and

that provision being made for their needs, less vital action will be taken to relieve the poorer and the more careless classes. This should not argue against the introduction of the system, but in favor of attention to quarters now neglected. It is suggested that where dry removal is not possible, the problem may be solved if town authorities will introduce and enforce a system of water-tight, ventilated vaults, with a proper pneumatic system of removal entirely under their control wherever the "sub-irrigation" system is not privately introduced. Regular and frequent cleansing of the vaults should be secured, and crucial inspection of their imperviousness would be necessary.* Processes for utilizing the contents of these vaults are available, and in many communities the financial returns might be made to largely repay the cost of removal. Such results are only possible through organized system. This seems difficult to secure, but communities must be taught its value and need.

Proper care is not exercised in removing house wastes, and the public is too prone to consider any system which is compulsory a burden not patiently to be borne. The removal of the waste products is just as important as provision of food.

For many communities in the State, now unprovided with systems for the removal of house-sewage, I believe that nothing which has as yet been presented can take the place of properly designed and equipped sewerage systems.

SEWERS.

Recent improvements in the design and construction of sewers, reduction in the price of materials, and the benefits of competition have so largely combined to produce economy and efficiency that it is questionable if there is any town in our State having a public water-supply that can afford to properly remove its house-sewage in any way but through a system of sewers intelligently designed and carefully constructed. The wide application of the small pipe system (to carry only house-sewage) has greatly reduced the magnitude of this problem.

* The disposition of wastes after they are collected at any one point is a matter for careful and competent advice for each case. The nature of the wastes, the demand for resulting products, the character of the neighborhood and surroundings, the expenditure possible and a host of complexities prevent any general deductions. Crematory processes have lately been so much simplified and perfected that they cannot be neglected when considering economy and cleanliness. They are particularly applicable as adjuncts of the systems of "interception."

As soon as any proper removal of wastes is demanded the economy and convenience of these small pipe systems will be more fully realized.

It has been felt in many of our inland towns, having no outlet for sewage into large volumes of water, that the introduction of a sewerage system involved certain nuisance in disposing of the wastes. The troublesome questions of sewage disposal are largely exaggerated by casual thinkers; in fact, there is very general belief in many sections that *purification of sewage* on a large scale is chimerical. When the financial bubble—proposing to rapidly reap wealth from water-carried sewage—exploded in England several years ago a reversion of sentiment resulted which found expression in a motley literature. Those unfamiliar with the facts are apt to construe these expressions into sweeping condemnation of sewage purification processes. It should be remembered that the problems in England which have caused immense difficulty and discussion are on scales far out of proportion to the needs of our State. There is no town in the State which need hesitate to introduce a "separate" system of sewers because of difficult disposal. Knowledge of processes satisfactory under the most crucial tests will guide in solutions here. Processes for utilizing dilute manurial agents are really in a fair state of perfection.

In conclusion, it must be realized that public health is not a matter to be trifled with by reckless individuals who are content to jeopardize their own existences in the midst of disease-fostering conditions.

There is need for a centralizing controlling power, which is interested not only in the sanitation of the wealthier and cleanlier sections of the town, where proper sanitary conditions are perhaps most liable to exist, but also in that of the hovels and tenements. The weakest link of a chain measures its strength. The vilest section of a town may be the measure of its immunity from disease or contagion. We have grown to recognize the advantage of fire districts in our cities; to admit the need of building regulations and items in the control of the food-supply and some few principles of domestic sanitation. The next step should be in the direction of systematic and compulsory removal of dangerous filth from the vicinity of dwellings. Present regulations are entirely inadequate. In England, under the Public Health Act of 1875, every local authority may, and when required by order of the Local Government Board shall, themselves undertake or contract for the removal of house refuse from the premises; the

cleansing of earth closets, privies and cesspools for the whole or any part of their district. We have no such central authority. It is a question if this is not a weakness in our form of government; but in its absence the minds which mould and form public opinion should endeavor to lead in practical efforts of reform. We can proceed no faster in these matters than public opinion will sustain.

Anything which increases the demand for honest and intelligent protection and preservation of health merits our encouragement and support. If we then run counter to prejudice and present practice, we must meet the issue squarely and manfully. Reforms are not readily secured, but we need not despair when life and health are the rewards.

THE WORK OF THE PLUMBER, AND THE DISPOSAL OF SEWAGE.

BY J. J. POWERS, SANITARY PLUMBER, BROOKLYN.

I have been invited to speak on the work of the plumber, and the disposal of sewage. I shall be as brief and practical in my statements as possible, and trust you may find them of interest.

My connection with the plumbing trade began some twenty years ago, at a period when the favorite metal for soil and waste pipes was lead; these pipes were usually supported by straps of sheet-lead soldered to the pipe on either side and secured to the walls with screws or hooks. The vertical soil and waste pipes in buildings were considered the proper place to display the skill and taste of the mechanic, and the work on them was generally good and well-jointed. The traps used were all made by hand, being beaten out of sheet-lead in two pieces, and soldered together on the sides. The manufacture of these traps constituted a large part of the plumber's shop-work in the winter months. Age and experience, however, developed the facts that no matter how well the lead pipes were supported their weight "sagged" them, and, the fastenings being immovable, the result was a break at the upper or lower side of each support, and the traps and bends were usually corroded through at the edge of the soldered seam which united the two sections. Added to these unfavorable experiences was the fact that the progressive intellect of man had discovered how to make very thin lead pipes. The old lead pipes were expensive and troublesome to repair, and it pained the plumbers to have to make such large charges for repairs to their customers, so they sought for a substitute, which they found in iron. Unfortunately, they still retained the notion that soil and waste pipes must be very thin; and as the germ theory had not yet been introduced into the plumbing business, the necessity for air-tight joints between the lead branches and the iron hubs was not generally realized nor acted

upon. The horizontal house sewers were generally constructed of glazed sewer-pipes, which were laid beneath the cellar floors by laboring men who usually paid more attention to grade and alignment than to perfect jointing.

In the cheaper class of houses, the water-closet traps on the second floors were considered sufficient seal for all the waste pipes leading to the various basins; this was a serious mistake, because, under this arrangement, there were frequently from 30 to 60 feet of untrapped waste pipe, and from their filthy, gelatinous linings gases of decomposition escaped into the sleeping-rooms. But as the development and escape of gases were not at that time considered by the architect who designed, or the plumber who constructed—the plumbing of houses in that period was not of a nature to fulfill the requirements for the prevention and exclusion of sewer gases from polluting the air within the dwelling. Plumbers never introduced vent pipes except in cases where they had reason to expect an "air bind," and only did it then to facilitate the flow of water. In brief, the plumber's work was considered successfully accomplished when the water freely ran from the supply pipes, and the waste waters were quickly carried off through the discharge channels.

But these halcyon days soon came to an end; the rapid growth of the cities and consequent impaction of people, was followed by a rapid increase in the number of cases of infectious disease. The steady, presevering and critical researches and investigations made by our self-sacrificing and public-spirited friends and benefactors, the medical practitioners of these communities, eventually revealed the fact that some connection existed between these diseases and defects in the plumbers' work. This was the first step towards improvement, and to physicians are the public indebted for the advance in experimentation and investigation. After this, rapidly, followed the evolution of the sewer-gas theory, which resulted in forcing upon the plumbers and sanitary engineers many microbes, to be taken care of in some manner least prejudicial to the public health. As the plumber's knowledge of animalculæ was comparatively limited, owing to the fact that up to this period he had not been obliged to study nor be responsible for any microbe more diminutive than the average plumber's helper, his position was very unpleasant, particularly so as these microbes, when inhaled by the plumber, utterly refused to develop disease within his germ-proof internal organs; consequently he was thereby prevented

from forming any judgment based on practical experience, for plumbers seem to thrive on sewer gas physically, as well as financially.

The results of the first efforts in ventilation, in a great number of cases, intensified instead of correcting the evils, because *sheet-iron* pipe was used to extend the soil and waste pipes to the roofs. The waste pipes of basins were trapped at the basin end as well as in the water-closet trap. Ventilating pipes were carried into chimneys, yard-vaults were abandoned and water-closets substitued in cellars, all of which tended to make bad worse. But as soon as the plumbers commenced to understand the fact that their business had assumed a professional character, requiring from them a certain amount of scientific knowledge, it must be admitted that they made strenuous efforts to meet the requirements of the physicians, and have certainly made marvelous progress, considering the fact that the knowledge required had to be attained immediately, yet was of a character difficult to comprehend without long study, combining, as it does, elements of chemistry and hydraulics.

The improvements in plumbing within the last ten years are simply phenomenal. The bath-rooms and water-closets are as clean and odorless as the parlors, when good fixtures are used and properly set. The great competition has brought the price of first-class fixtures of all kinds down so low that there is no excuse for any property-owner not to provide his houses with suitable and cleanly fixtures. But there is one improvement that is very desirable and inexpensive that should be adopted in every new piece-work or alteration. When the main lines of soil and waste pipes are in, and the lead branches carried to beneath the location of the various fixtures, the ends should be stopped and the whole system filled with water to the roof to prove the reliability and tightness of the work. In all cases extra heavy iron pipe and fittings should be used and lead pipes for branches of corresponding thickness.

The rules for the arrangement of soil and waste pipes, and the proper trapping thereof, are so well laid down in the printed forms of the Brooklyn Board of Health, and so familiar, that I do not think it necessary to enlarge upon that subject.

The question of trapping I will illustrate by an experiment, showing you the merits of the two forms of traps commonly used. The siphon action is so apparent and well known that it is not necessary to dilate upon it.

In regard to the question of final disposal of human excreta and wastes, the plumber is continually called upon to decide how to dispose of the sewage from isolated mansions. Until within a comparatively recent period, the method of disposal was by discharge into deep cesspools built of stone and brick, laid up loose-jointed so as to permit of soakage into the earth. This was the accepted and favorite method of disposal on many homesteads during the past century or more, and for convenience the privy, cesspool and well were located contiguous to the house and close together. In course of time, the earth between the cesspools and wells became saturated and the sewage found ready means of inflow into the well, where it was finally disposed of by being used for domestic purposes and drank by the family, or their guests. This method of disposal had so many serious objections that in deference to the prejudice of the guests and their physicians it was abandoned, although it was not easy to convince the people who had used the wells for many years that the method was not specially advantageous.

Now, the provision of cesspools, even if water-tight and ventilated, is universally condemned, except as a temporary expedient while awaiting the construction of sewers. The disposal by intermittent discharge into irrigation tile is always preferable, but requires considerable land. The question is rapidly becoming very serious for inland towns, and great progress will necessarily be made in the next few years.

I believe that all the sewage which is discharged into the earth or streams should be chemically treated before discharge, so as to minimize the absorptive work in the soil. In large plants the chief object to be attained is a minimum of offense at the place of precipitation and treatment and as complete a clarification of the fluids as possible. To fully illustrate my views, I will demonstrate by two experiments, showing the two systems I have often used for the chemical treatment of sewage by per chloride of iron and chlorine.

Both systems are in successful operation and I am satisfied with the result.

In conclusion, permit me to say, that the plumber of the future should combine and possess the professional education of sanitary engineering with the mechanical knowledge of his trade to do justice to a business which is fraught with so much interest to the welfare of the community.

I believe that the plumber is in a more receptive condition for this

knowledge after he has acquired his mechanical skill, and I think the proper place for him to receive it is at the medical colleges in the form of courses of lectures and experiments, which will convey to him a sense of the great responsibility devolving upon him in the construction of his works. As the physicians and chemists are the persons who must necessarily first observe and recommend the need of hygienic changes in the dwelling, the plumber should also have the benefit of their counsel and instruction.

THE PHYSICAL LAWS OF PIPES AND FIXTURES AND THEIR CONTENTS.

BY PROF. C. F. BRACKETT, LL.D., PRINCETON.

Many of the facts in science which we are accustomed to put into daily operation have been known from early antiquity. None have been more clearly perceived or more undisputed than that law in hydrostatics which asserts that when we connect different vessels together by means of pipes, the liquids which they contain will stand at the same level in them all, provided the liquids have the same density. Suppose then, that we have a series of vessels connected by means of pipes, and that water were poured into one of the vessels, of course we shall find that the water rises to the same height in them all. If one of the vessels be replaced by a pipe or tube of very small diameter, we find that the water stands at a greater altitude in this than in the other vessels. If, however, the liquid under trial be mercury and the small tube be of glass or of any material which the mercury does not wet, then the liquid mercury stands at a lower level than in the connected vessels. It thus appears that it is impossible to make a full discussion of the simplest laws which *regulate the height of liquids in connected vessels* without taking into account the nature of the liquids themselves. In the first place let us consider the nature of water. Inquiries have been instituted in other countries as well as in our own to detect, if possible, the character of the surface action which is always present at the junction of the liquid surface with some other surface such as that of the containing vessel or the air. Dr. Thomas Young was the first who consistently developed the doctrine that the surface of water, and liquids generally, is covered with a stretched membrane or film. I here describe a very striking experiment which I think will convince any one of the truth of this assumption as a physical fact. Provide a glass of perfectly clean water, some ordinary paper and a little oil. Also provide a pair of

pincers. Immerse the paper completely so that it shall be thoroughly wetted and wholly below the surface of the water. Place one drop of the oil on the surface of the water. It will be observed to form itself into a globule more or less perfect, but somewhat flattened. This after oscillating about a center of motion, will come to rest. Now insert the pincers and draw the paper slowly out of the water so as not to touch the oil globule. The moment the paper emerges, the drop of oil is deformed. It no longer retains its semi-globular shape, but as the paper is more and more drawn out, the shape of the oil is altered. If, now the paper be pushed back under the water the oil reverts to its original form.

The explanation is very simple if we admit that the surface of the water as well as the surface of the oil is in fact a stretched film. In this case it is easy to see that the circumference of the oil globule is everywhere invested with the film of water which forms its surface, and when the paper is drawn out there is a tension put upon this film which pulls the oil out of its proper form. It may be remarked in passing, that the nearly globular form of the oil is due to the tension of the film which constitutes its surface. The reason for the existence of the film at the surface of any liquid is found in the fact that the molecules at the surface are not subject to the same attractions on every side as are those which lie at points distant from the surface, that is, beneath it.

Now the fact that there is a film at the surface of every liquid must not be forgotten when we come to deal with the theory of the behavior of liquids in pipes. If a plate of glass be plunged vertically into water it is found that the water does not come sharply and squarely up to the surface of the glass, but comes in contact with it at an angle differing from a right angle, in general very acute and depending on several conditions, such as the cleanness of the glass, the purity of the water, the temperature, etc. If the glass plate be in the horizontal position, and a drop of water be placed on it, the drop will spread out in a thin layer, which, if the plate be perfectly clean, may entirely cover it. On the other hand, if we place some mercury on the glass it will gather itself up into a flattened globule.

Exactly the same kind of action occurs at the surface of these liquids and that of tubes with which they may be in contact. It is not difficult to exhibit this action in a striking way by means of a small glass tube and water. Suppose the tube have an internal diameter of one-

eighth of an inch. Introduce a short column of water and then allow a little air to enter to be followed by more water and air in small quantities, at a time respectively, till the tube is occupied with alternating sections of water and air. Now, if the attempt be made to blow the whole of the contents of the tube out so as to leave the tube empty, it will be found to be very difficult, if not impossible, to do so. Here, then, we have a very considerable resistance offered to the passage of liquid through the tube. This force, or better, this opposition though much less in tubes of larger diameter, may not be neglected in them, when such a condition as is under consideration prevails.

Let us consider a system of pipes, of whatever kind, intended to convey water into our dwellings. Whatever principles we find to be applicable to these will also be applicable to the pipes which convey away the water, after it has served its use, provided the pipes are alike in their general structure and character.

Let the end of this short tube, which I hold in my hand, represent the section of a pipe. Suppose that in some way the section has been diminished. This will be done if the pipe be compressed, as will be likely to occur in bending it. The carrying capacity of the tube will be diminished. Now a question of great importance is at once presented as regards the results which flow from this constriction when water is made to flow through the pipe with a constant velocity. I suppose it would seem probable to most of us, considering the problem for the first time, that there would be greater pressure at the point of constriction than elsewhere. If, in order to test the matter, a long tube be taken, having a constriction at the middle, and furnished with small tubes, inserted laterally, one at the constriction and others on either side of it, and made to discharge water under a head, it will be found that there is less internal pressure at the point of constriction than elsewhere, as will be clearly shown by the heights at which the water will stand in the several small inserted tubes. If we take a case exactly the converse of this—that is, one in which the tube has an enlargement instead of a constriction—it will be found that there is greater pressure at the point of enlargement than elsewhere.

Thus, we find that there is increased pressure in consequence of enlargement and diminished pressure in consequence of constriction. The bearing of these principles on the behavior of pipes in certain of our sanitary arrangements is obvious, and I need not dwell upon it.

Let us now consider a pipe, having a perfectly uniform, smooth bore, with reference to that surface action of liquids spoken of before, in virtue of which the surface becomes a stretched film. When the tube is filled with water there is an adhesion between the surface of the water and the walls of the tube. The result is that there is an attached lining of water which is not dislodged, even when the water flows at a very considerable velocity. This layer lags behind, therefore, while the next one lags less and so on. Thus, the water flows with greater velocity in the central portions of the tube in consequence.

In our sanitary arrangements we are accustomed to employ pipes in which the phenomenon we have just been considering is of decided importance. If, in addition, the caliber of the pipe in a given case be wanting in uniformity of course the differences in pressure before discussed will be present, and there will be eddies set up which will more or less obstruct the flow of the water. If there be also present air of gas or any kind, this will constitute another complication. Suppose we knew the value of each one of these factors, and that we had effected a perfectly harmonious adjustment of them so as to secure the actual service we desire in a particular case, and that we had made our household arrangements on that basis. Is there any assurance that disappointment will not follow? Not at all. The surfaces of the pipes will change in character from rust and deposits of various kinds.

Before taking up the conditions on which another practical matter depends, I wish to describe an experiment of great interest, and which, also, will help to make the matter in view clearer. We can make water to constitute its own tube for conveyance from one vessel to another. Prepare two buckets by inserting in the side of each of them a small circular tube of very short length. Place the two buckets so that the tubes are opposite each other, and so that their axes coincide in the same straight line. If now one of the buckets be filled with water the jet which issues from it will pass directly into the tube of the other, and so the water is passed from one bucket into the other without the aid of a solid pipe—the film of water which invests the stream being the only tube needed. If water be poured from a pitcher in a stream it is observed that the diameter of the stream is greater as it leaves the pitcher than it is at any point lower

down. But it is evident that just as much water is passing across a cross section of the stream at one point as at another, otherwise there would be an accumulation of water at the points where the smaller portions were passing. It is clear that the increased velocity of the stream at the lower points makes up for the diminished size.

Now suppose a tube be place vertically and water be kept flowing through it. On account of the capillary adhesion between the water and the walls of the tube, the water tends to fill the tube at every point—at the lower end as well as at the upper. By the increase in velocity, the column of water in the tube tends to become smaller in section as it falls. The only resultant possible in the circumstances is the decrease of pressure in the tube at these points lower than the surface of the water which supplies the tube. In other words, there is a tendency to form a vacuum. Complete proof of this conclusion will be obtained if an opening be made through the side of the tube. Instead of the water flowing out, it will be found that the air is forcibly drawn in through the opening. Such an arrangement is often used for an air-pump.

If a clean, sharp opening be made through the thin wall of a vessel containing water, and so supplied as to keep its surface at the same height notwithstanding the flow through the side, and if a vessel be set to receive the water which flows out, we may ascertain the amount which flows out in a given time. Let this be done, and call the amount unity. Now insert a short tube—of length equal to its diameter—the diameter being equal to that of the experimental opening just described, and ascertain how much water flows out of the vessel in the same time as was employed in the previous experiment. It will be found to be much in excess of that which ran out in that experiment. In other words, when the short pipe is used there is a greater flow than where there is an apparent unobstructed flow. These and other familiar facts, I suppose, are known to you all. They are cited to remind us that we have them among other factors to deal with in the sanitary arrangements which we are called upon to construct, and which employ pipes for the conveyance of liquids. When all the conditions are adequately known, there is a calculable duty which may be determined mathematically. But as already seen, the system which we have at any given time is not the system which we shall have at some subsequent time, especially in the case of pipes destined to

receive the waste products of the household. As to the disturbances due to the introduction of air, they may, under certain circumstances, be avoided. If pipes be everywhere so laid that there are no upward curvatures to hold the air which is certain to be introduced with the water, no trouble from this source need be apprehended. Circumstances, however, may arise in which the case will be quite otherwise.

If the object be simply to bring clean water into the dwelling, there are a number of inconveniences which may be tolerated, such as imperfect joints, faulty stop-cocks, etc., and no serious injury need result. But the case is otherwise when the water has passed the sink or closet and entered the system of pipes which conduct it to its final destination—the sewer. In this region, all that has been said in relation to the character of the liquids, to the diameter of the pipes, etc., will need to be studiously considered. In order to appreciate the changed action which may occur when water which is not clean is to be dealt with, consider the experiment now briefly to be described. Let there be a conical tube of about an inch in length, and, preferably, let it be of glass having its end diameters, say, about an eighth and a sixteenth of an inch respectively. If this tube be filled with water, the water will be retained by capillary action, and we shall note that the surfaces of the water are concave at the extremities of the tube. If the tube be held in an inclined position, the water will remain in equilibrium with no tendency to fall out of it. While it is thus in equilibrium, if one end or the tube be touched with an oily substance, the equilibrium is at once destroyed, and the water falls out. The contamination of the water with an oily matter has acted on its investing film very much as a knife would act to cut an ordinary stretched membrane.

The film which covers the free surface of water is a very tough one—much stronger than the well-known soap films with which we have all played, I suppose, in childhood. With the soap solution properly prepared very large bubbles may be blown, but the same is not true of water. How, then, is it that the film of the water is of greater strength than that of the soap solution? It was shown by Professor Henry that the tensile strain required to pull a given section of water apart is about the same as would be required to pull apart an equal section of ice. This may help us to understand how great is the force required to separate a layer of water from another layer when there is no sliding motion allowed to the molecules.

There is another property of water which causes it to behave, when conveyed in pipes, like a solid. That is its incompressibility. When a long column of water is moving in a pipe with a high velocity, and is suddenly arrested by shutting a valve, the effect is at once manifest by the sudden blow which is given, and which may even be sufficient to rupture the pipe.

There is considerable amount of air dissolved in water under ordinary conditions, the amount, other things being equal, depending on the pressure to which the air and water are subjected. Now it is obvious that in the case where a pipe is carried upward to a considerable height and then descends, there is less pressure at the higher parts of the pipe than at the lower parts. Hence it happens that some of the air which under the greater pressure remained in a state of solution is set free and so accumulates in the upper parts of the pipe, where unless the effective head is sufficient to sweep the air along with the water it will accumulate and form an obstruction to the further flow.

If we consider distinctively the condition of the waste pipes which convey the refuse from our dwellings, it is evident that there must result from the mixture of matters passing into them ever varying complications, so that it will be impossible to say at any given moment whether they are in a condition to discharge their proper functions or not.

Briefly restating a few of the matters touched upon, we have capillary phenomena in our pipes, provided the diameter of any of them be small enough. We have, in vertical pipes, diminished internal pressure resulting from the adhesion of the water to the walls of the pipes together with the increasing velocity of the descending liquid; and we have unknown complications arising from the mixed matters which contaminate the water passing through our waste pipes.

In practical plumbing the question arises in respect to the caliber of the trap which must be introduced to prevent the ingress of noxious gases. Should the trap be of larger, of smaller or of equal bore with the pipe on either side of it? So far as the effect of an enlargement or that of a constriction is concerned, we have already said enough, and if there were no other complication there would be no great difficulty in deciding the question. But we must remember that the effect of the trap is to change the direction of the flowing

water suddenly, and that this cannot be done without setting up corresponding disturbances in the flow. The resistance offered to the passage of the liquid, and the consequent retardation, will be as the square of the number representing the velocity of the liquid. Again, if there be two tubes or two sections of the same tube which differ in diameter, the relative amounts of liquid which they can convey, other things being equal, will be as the squares of their diameters respectively. Increasing the diameter of the pipe increases the carrying capacity, while increasing the velocity of the flow increases the resistance.

I only intended to discuss a few matters suggested by the title which is entered against my name without attempting anything like a logical treatment of them, as this would manifestly be impossible in the time allotted. I may say, I think, in conclusion, that it is utterly impossible, in the present condition of sanitary science, to lay down any rules of practice which shall hold for all occasions. *The sanitary engineer must know not merely these facts which we have hastily presented, but a large number also to which I have not adverted.* He must not only know them but he must keep them constantly in mind and deal with them just as the physician deals with the facts he finds at the bedside. Would it be proper, on seeing a man who was ill, to prescribe without inquiring into the cause of his difficulty? The proper course is to consider every circumstance which can cast any light on the present condition of the patient—his habits, his constitution, the influences to which he has been exposed, in short, every factor entering into the case must be taken into account and carefully discussed till the seat of the mischief is found. Exactly so is it with the sanitary engineer who goes to make an inspection of a house or other building in which modern conveniences are to be found. He has to inquire with respect to the cesspool or sewer. How is the building situated with reference to the one or the other, as the case may be? How many feet of pipe are employed? Is the pipe straight or does it contain angles? What is the pressure from this or that closet? To make the matter short, what are the symptoms which, altogether, must be dealt with in this case? When mischief has occurred it is not enough to prescribe a trap here or to say that there should not be a trap there. The thing to be determined is not simply whether there should or should not be a trap. If the question be settled

affirmatively, what kind of a trap should it be? How should it be ventilated? These and similar questions must be answered.

In every internal arrangement, let the sanitary engineer and the plumber—if we could make him, which I suppose is hopeless—at any rate, let the householder take pains to inform himself respecting the general principles which must be involved in any plan, and then, of alternative plans, choose that which has the least chance of evil. Secondly, always secondly, select with reference to economy in construction, for true economy lies on the side of safety.

ILLUMINATING-GAS; ITS HISTORY AND ITS DANGERS.

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It will be our purpose in this paper to give a brief history of illuminating-gas, to describe the processes formerly and now in use in its manufacture, and the different fixtures and other appliances generally employed in gas-lighting, also to point out the principal annoyances and dangers connected with this method of illumination, and the means of overcoming and avoiding them.

HISTORY OF ILLUMINATING-GAS.

History will be searched in vain for an account of the introduction of illuminating-gas. Hidden in the earth are accumulations of hydrocarbons from which gases have been naturally evolved for ages. The miner, plying his daily vocation with pick in hand, breaks into the seams of coal and a gas pours out which has been confined perhaps for centuries. This is his deadly enemy, the fire-damp, a gas which is formed in the production of coal from vegetable matter. It is known to chemists as methane, marsh-gas, or light carburetted hydrogen, and is one of the constituents of the illuminating-gas in daily use. It is very combustible, but, like hydrogen, produces but little light, though giving an intense heat. It is this gas which, when mixed with air, forms the explosive compound so fatal to the miner, and also to the householder who incautiously carries a naked light into the cellar where gas has escaped from some leaking pipe. It is composed of one atom of carbon and four of hydrogen, its chemical formula being CH_4. In various parts of the world there are gas-springs or wells from which natural gas escapes, being set free from some accumulated hydro-

carbons deep down in the earth, and it is from such sources that the so-called "eternal fires" have their origin. One of these exists at Baku, near the Caspian sea. But such natural emanations of gas are sometimes of more practical use than the furnishing of the deadly fire-damp to the miner, or the eternal fire to the superstitious Asiatic. The Chinese, justly renowned for their wonderful adaptive genius, have for centuries employed natural gas for the evaporation of the brine in their salt-mines near Pekin, conveying it long distances in bamboo tubes. In more recent times the village of Fredonia, N. Y., has been lighted by gas which comes from a bituminous limestone of that region; the gas being a mixture of marsh-gas, CH_4, and hydride of ethyl, C_2H_6. And still more recently natural gas has been conveyed for miles and utilized for lighting and heating, as in Pittsburg and Buffalo. In England a natural gas, consisting mainly of marsh-gas, has been known to come from peat-bogs. These natural gases are emanations from different hydro-carbons, and will therefore differ in their composition. Thus the gas from the coal mines is marsh-gas, that used in Fredonia, marsh-gas, while that which flowed from a well sunk at West Bloomfield, Ontario county, N. Y., in the year 1865, while searching for petroleum, was composed of marsh-gas, carbonic acid, nitrogen, hydrogen and illuminating hydro-carbons.

What nature has thus done for some communities by storing up hydro-carbons in the earth, man must do for himself in those localities where, in furnishing the equipment for the maintenance of civilized life, nature has not supplied the materials out of which illuminating-gas can be manufactured; that is to say, man must transport the hydro-carbons from the place of their formation to the localities where they are, by artificial processes, to be transformed into gas for the purposes of heat and light.

As is the case with most valuable discoveries, the credit of introducing artificially prepared illuminating-gas into practical use does not appear to belong to any one individual, though to William Murdoch, a Scotchman, more credit is probably due than to any other one man. Not far from the year 1700 the Rev. John Clayton, Dean of Kildare, observed that the water of a ditch in Wigan, in Lancashire, would burn like brandy, generating heat enough to boil an egg. He had the ditch dammed and the water removed. In the bottom an excavation was made, and after digging a foot or two in the earth a bed of shelly coal was reached. The gas which came up from this bed

ignited when a flame was brought in contact with it. He put some of this coal in a retort, which he heated in a fire; the gas which resulted he found could be ignited, and even kept in a bladder and burned at pleasure. This may, in reality, be regarded as the discovery of coal-gas, and the Rev. John Clayton as its discoverer; but he seems never to have made any other use of it than to amuse himself and his friends.

In 1787 Lord Dundonald, while making coal-tar, obtained a gas with which he lighted Culross Abbey, in Scotland. This is the first instance which we have been able to find where an artificial gas was employed for the lighting of a structure. In 1786 Dr. Rickel, Professor of Chemistry, at Würzburg, lighted his laboratory with gas made by the dry distillation of bones.

In 1792, Murdoch lighted his house and office, at Redruth, Cornwall, with coal-gas which he made himself. He also put a light in a steam-carriage in which he traveled from his home to his mines. Subsequently he removed to Old Cumnock, in Ayrshire, Scotland, and here he also employed coal-gas as an illuminant. In the year 1798, being then employed by the firm of Boulton, Watt & Co., at Soho, he constructed gas-works and lighted their factories with gas. This new method of illumination, to the exclusion of others, was soon extended into neighboring factories.

But little attention seems to have been paid to this innovation, and it was not till 1802 that there was any public exhibition made of it. Then, in the celebration which occurred at the signing of the treaty of Amiens, Murdoch exhibited two copper vases at his works, with two immense flames of coal-gas issuing therefrom. Pall Mall, London, was the first street lighted with gas; this was in 1807. The first gas company was chartered in London in 1812, under the name of "The London and Westminster Chartered Gas Light and Coke Company." In 1813 Westminster Bridge was lighted by gas, and in 1815 this method of illumination was introduced into Guildhall. The difficulties which this company had to encounter in their efforts to introduce gas into general use were such as have presented themselves time and time again to the advocates of public improvements which are novel. The objections which they were obliged to meet came not only from the general public, which could not be expected to do other than oppose, but from men as educated and scientific as that great chemist, Sir Humphrey Davy. He regarded the idea of lighting London with gas as so supremely ridiculous that he contemptuously inquired of the

engineer whether it was intended to take the dome of St. Paul's for a gas-holder. The engineer answered that the day would doubtless come when gas-holders would be as large. This prediction has been more than verified; the diameter of the dome of St. Paul is but 145 feet, while there is at least one gas-holder in the world with a diameter of not less than 200 feet, and one now being built in London with a diameter of 250 feet. For two years the company supplied gas to shops and houses without cost, in order to persuade people that it was both safe and useful. It was, however, for a long time looked upon with great suspicion. When the government at last consented to permit its introduction into the House of Commons, the architect required that the pipes be placed four or five inches from the wall, so that the heat would not set fire to the buildings. A commission appointed by the government to investigate the works of the company, recommended that large gas-holders should not be permitted, for fear of explosion, and that the holders should be enclosed in strongly built structures, so that if an explosion should occur surrounding buildings would not be injured.

One of the great practical difficulties was to provide suitable pipes for the conveyance of the gas from the works to the consumers. Patents were issued for pipes of wood and paper; gun barrels were screwed together, and at last pipes were made of wrought-iron. By the year 1816 popular and governmental prejudice had so far diminished as to permit of the general introduction of gas into the streets of London, and into most of the shops and public buildings, but it was a long time before it was generally admitted into private houses.

The honor of first making gas in the United States is attributed to David Melville, of Newport, R. I., who in 1807 lighted his residence and the street in which he lived. Ten years subsequently he lighted Beaver-Tail lighthouse with it. For general use gas was first successfully made and used in Baltimore, in 1821, in Boston in 1822 and in New York in 1823. In this latter year the New York Gas Light Company was started, but was not successfully at work until 1827, making their gas from oil and resin until 1849. It is estimated that there are at the present time more than five hundred gas companies in the United States, the capital of which mounts up into the tens of millions, that in New York alone being $45,000,000.

PROCESSES OF MANUFACTURE OF ILLUMINATING-GAS.

We come now to the consideration of the different processes by which illuminating-gas is made, and as coal-gas was the first made, shall first describe concisely its manufacture. Inasmuch as the production of gas from coal in quantities necessary for the lighting of a town or a city is nothing more than the reproduction on a large scale of what takes place in a burning candle, we shall, before taking up the manufacture of gas, describe the changes which take place in a candle when burning, hoping thereby to simplify and make more intelligible the more complicated commercial processes.

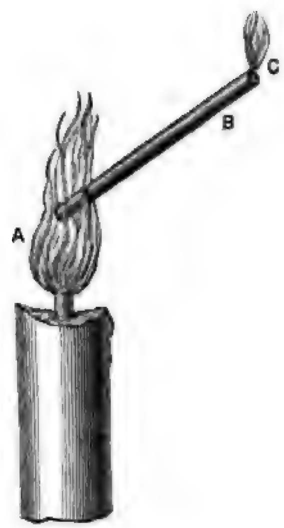


Fig. 1. Candle-flame.

In the production of light by combustion, three chemical elements are involved; these are hydrogen, carbon and oxygen. The process is briefly a chemical one, in which hydrogen and carbon unite with oxygen, or in other words it is oxidation. The wax of the candle is composed of hydrogen and carbon. When the wax is heated by the flame it melts at the part immediately surrounding the wick, and in its melted condition is drawn up into the wick by capillary attraction. The end of the wick being in the center of the flame no oxygen has access to the oil which has thus been drawn up, but it is here exposed

to a great heat, and is thus subjected to a process of distillation in all essentials similar to that which occurs in the retorts used in making coal-gas, hereafter to be described. As a result of this distillation the hydrogen of the oil or melted wax is set free and burns, producing but little light, though an intense heat. This is a process of oxidation, of which the product is water. If a tube is passed into the interior of the flame where the gas is which is formed by this distillation, the gas may be conducted by a tube out of the flame, and burned. (See Fig. 1.) Or it may by the same means be led to a receiver and there stored to be burned whenever desired. The heat caused by the burning of the hydrogen raises the carbon to a white heat, and the luminosity thus produced constitutes the flame. Oxidation again occurs in this incandescence of the carbon particles, and carbonic acid gas is the result. In the candle of our fathers, the wick became so long, as the tallow was consumed, that the temperature of the flame became lowered, and the carbon not being thoroughly oxidized was given off as free carbon, smoke and a diminution of the illuminating power being the results. In order to prevent this the snuffers were employed. In the modern candle the wick is so constructed that as the candle is consumed the wick twists to one side and is burned at its end, never remaining sufficiently long either to impair the flame or to cause it to smoke; it therefore requires no snuffers. In the production of the candle-flame hydrogen and carbon are oxidized, and water and carbonic acid are produced. Until the electric light was introduced it might be truly said that the production of light for illuminating purposes was in all cases an oxidation of hydrogen and carbon. Any hydro-carbon may be employed for this purpose, but practically that one is selected which will produce the best light at the least expense. In most countries coal has most fully met these requirements, and hence, the gas obtained from coal has been the illuminant most generally employed; although, as will be seen, various oils and other compounds containing hydrogen and carbon have been utilized in the production of illuminating-gas.

As has already been said, all substances which contain hydrogen and carbon will, when heated to the point of destructive distillation, give off gases which are inflammable. Although the number of such substances in nature is without limit, still there are not many which can practically be used for this purpose. Coal, petroleum, resin, wood, peat and oils may be thus utilized, but as a rule the ones selected are, for many reasons, either coal or petroleum, or a combination of the two.

There are three varieties of mineral coal—these are anthracite, bituminous and lignite or brown coal. Anthracite is poorly adapted to the production of illuminating-gas, for the reason that in the very process of its formation much of the gases have been driven off. When, therefore, this variety of coal is heated in retorts, it can yield but little more. And yet that it still contains enough to do much harm is evident from the fact that death sometimes occurs from the inhalation of the gas which is produced from anthracite coal, in the ordinary coal-stoves, when the combustion is imperfect. There is also no doubt that this gas, that is carbonic oxide, is injurious to health, even though it may not be present in sufficient quantity to produce a fatal result in those who inhale it. It is a common practice to put fresh coal on the furnace fire just before the occupants of the house retire for the night, and to close the damper in the pipe that goes to the chimney to such an extent that the pipe does not carry off the injurious gas which is generated. As a consequence of this the gas passes from within, out to the hot-air chamber, and saturates the air which is to heat the sleeping-rooms. Coal should never be put in furnaces or stoves the last thing at night, but sufficient time should be given for its injurious gases to escape through the chimney before the dampers are closed.

Anthracite coal is regarded as a natural coke, from which the volatile constituents have been expelled. Of bituminous coal there are three varieties—the caking, the non-caking and the cannel. The latter of these furnishes the richest gas, and hence where the cannel coal is the most abundant, as in Scotland and Lancashire, there the gas is the best. As a matter of fact, however, the caking coals are commonly used in the manufacture of illuminating-gas, being the most abundant and therefore the cheapest. They receive their name from the fact that by fusion they become a compact cake or coke, and this is of great value as a fuel. In order to make the gas from these caking coals still richer a certain proportion of cannel coal or other enriching material is added. The difference in the composition of these two coals is shown in the following analysis:

	Caking Coal.	Cannel Coal.
Carbon	87.75	75.25
Hydrogen	5.23	5.50
Nitrogen	1.70	1.61
Oxygen	3.80	13.83
Ash	1.39	2.81

In both of these coals iron pyrites (FeS_2) is found, the sulphur of which is a very objectionable substance, a portion being retained in the coke, while the rest is found in the gas, the water and the tar, and must be removed before the gas can with safety be delivered to the consumers. Nova Scotia coals contain from 3 to 5 per cent. of sulphur, those from Red Bank, Pa., 0.89, and from Westmoreland, Pa., 1.50 per cent.

If small pieces of bituminous coal are placed in the bowl of a common tobacco clay pipe, and the bowl tightly closed by clay and then placed in the fire, black smoke will soon be seen issuing from the stem. In a few moments gas will take the place of the smoke, and will burn if a lighted match be applied to it, and continue to burn for some time, while a tarry liquid oozes from the stem. After a while the flame will die out, and in the bowl will be found a residue, which is coke. This is practically a repetition of the experiment performed by the Rev. John Clayton about 1690, and represents essentially the present method of producing illuminating-gas from coal. In place of the clay pipe, clay retorts are used to hold the coal, and these are tightly closed to exclude the air. The gas, instead of being burned directly, is subjected to certain processes to remove the impurities which it contains, and stored in gas-holders, to be burned when needed. The tarry liquid and the coke also occur in the manufacture of gas on the large commercial scale, as in the production of gas in the clay pipe. The coke, as we have seen, is a most valuable fuel. The tar, which for a long time was regarded as a nuisance, is now one of the most important articles of commerce, as from it are produced the aniline colors now in such general use.

When bituminous coal is subjected to the process of destructive distillation, as in the manufacture of illuminating-gas, there is a large number of substances produced, some of which are solid, some liquid, and others gaseous. The following is the list of them given by Bunsen :

Coke	68.93
Tar	12.23
Water	7.40
Marsh-gas	7.04
Carbonic oxide	1.13
Carbonic acid	1.07
Olefiant-gas	0.78
Sulphuretted hydrogen	0.75
Hydrogen	0.50
Ammonia	0.17
Nitrogen	0.03

These products are very much more numerous than the above analysis of Bunsen would indicate, and in order to give some adequate idea of the great complexity of a substance, which is regarded by so many as a very simple one, we quote in full the analysis of Prof. C. F. Chandler, as given in Johnson's Cyclopædia, showing the composition of the products from coal in the process of gas-making.

I. COKE.

	Per cent.
1. Carbon	90-95
2. Sulphide of iron ($Fe_7 S_8$)	3-10
3. Ash	3-15

II. AMMONIA WATER.

1. Acid carbonate of ammonia, $NH_4 HCo_3$.
2. Hydro-sulphate of ammonia, $NH_4 HS$.
3. Sulpho-cyanide of ammonium, $NH_4 CNS$.
4. Cyanide of ammonium, $NH_4 CN$.
5. Chloride of ammonium, $NH_4 Cl$.

III. TAR.

1. *Hydro-carbons.*

	Formula.	Specific Gravity.	Boiling Points.	
1. Benzol	$C_6 H_6$	.850	82° C.	179.6° F.
2. Toluol, methyl-benzol	$C_7 H_8$	.870	111	231.8
3. Ethyl-benzol	$C_8 H_{10}$		132	269.6
4. Xylol, dimethyl-benzol	$C_9 H_{12}$	.867	140	284
5. Cumol, propyl-benzol	$C_9 H_{12}$	.870	153	307.4
6. Methyl-ethyl-benzol	$C_9 H_{12}$		160	320
7. Tri-methyl-benzol (Pseudocumol, mesitylene.)	$C_9 H_{12}$		166	330.8
8. Naphthaline	$C_{10} H_8$	1.153	220	428
9. Anthracine	$C_{14} H_{10}$	1.147	300	572
and a large number of others.				

2. *Alcohols.*

1. Phenol, carbolic acid	$C_6 H_5 OH$	1.065	180° C.	356° F.
2. Cresol, cresylic acid	$C_7 H_7 OH$		200	392
3. Thymol	$C_{10} H_{13} OH$		220	428
and others.				

3. *Acids.*

1. Acetic	$HC_2 H_3 O_2$	1.062	117.2° C.	243° F.
2. Butyric	$HC_4 H_7 O_2$	.9817	164	327.2°
and others.				

4. *Bases.*

	Formula.	Specific Gravity.	Boiling Points.	
1. Ammonia	H_3N	Gas.		
2. Methylamene	CH_5N	Gas.		
3. Aniline	C_6H_7N	1.028	182° C.	359.6° F.
4. Toluidine	C_8H_9N		205	401
and others.				

5. *Pitch.*

Oxidized bituminous bodies, whose nature has not been accurately determined.

IV. GASES.

1. *Luminants.*

	Formula.	Density.
1. Vapors of paraffines	$CnH_2n^4+_2$	
2. Propyle		
3. Other alcohol radicals		
4. Olefiant-gas, ethene	C_2H_4	.976
5. Propine		
6. Butine		
7. Naphthaline	$C_{10}H_8$	
and others.		

2. *Diluents.*

1. Hydrogen	H	.0691
2. Marsh-gas, Methane	CH_4	.5594
3. Carbonic Oxide	CO	.9727

3. *Impurities.*

1. Sulphuretted hydrogen	H_2S	1.1747
2. Ammonium sulphydrate	NH_4HS	
3. Bisulphide of carbon	CS_2	
4. Oxysulphide of carbon (?)	CSO	
5. Sulphurous acid (anhydride) (?)	SO_2	
6. Mercaptan, etc	C_2H_5HS	
7. Sulphur bases, etc		
8. Ammonium sulpho-cyanide	NH_4CNS	
9. Ammonium cyanide	NH_4CN	
10. Ammonium mono-carbonate	NH_4HCO_3	
11. Carbonic acid (anhydride)	CO_2	1.5240
12. Nitrogen	N	.9760
13. Oxygen	O	1.1026
14. Aqueous vapor (water)	H_2O	.6201

The process of destructive distillation is thus described in Johnson's Cyclopædia:

"When organic bodies are excluded from the air and subjected to heat they undergo decomposition, and the constituent atoms or molecules rearrange themselves into new compounds. In manufacturing

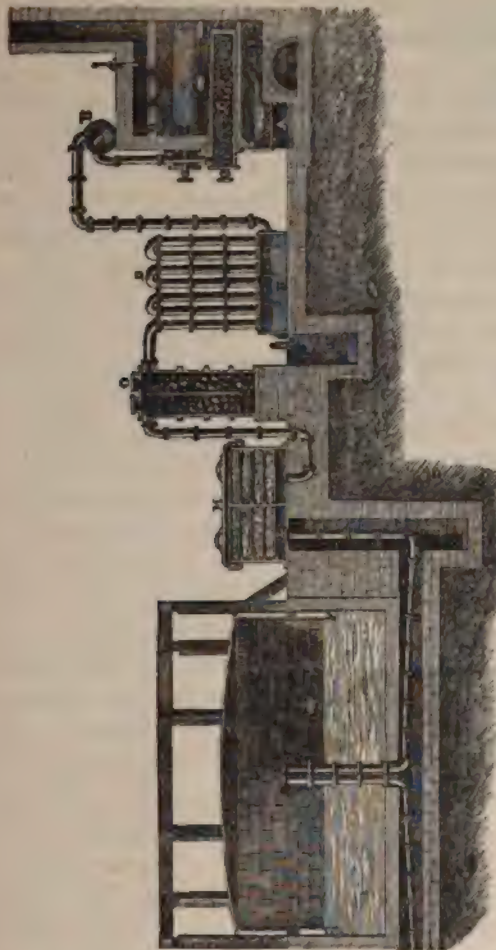


Fig. 2. Plan of coal gas works.

illuminating-gas the products are: 1. Coke, consisting of carbon, sulphuret of iron and ash; 2. Ammoniacal liquor, containing carbonate, sulphide, chloride, cyanide, and sulpho-cyanide of ammonium; 3. Tar, embracing a great variety of hydro-carbons, alcohols, acids and bases, among which are benzole, toluole, xylole, naphthaline, anthracine and carbolic or phenic, oxyphenic and cresylic acids, together with creosote; also several bases, aniline, iridoline and rubidine; 4. Illuminating-gas, containing light-yielding compounds such as acetylene, $C_2 H_2$; ethylene or olefiant gas, $C_2 H_4$; benzole, $C_6 H_6$; naphthaline, $C_{10} H_8$; propyle, $C_3 H_7$; butyle, $C_4 H_7$; mingled with hydrogen, carbonic oxide and impurities such as carbonic acid, ammonia, cyanogen, sulpho-cyanogen and sulphuretted hydrogen. Upon the temperature to which the coal is subjected depend the products of distillation."

MANUFACTURE OF COAL-GAS.

The manufacture of illuminating-gas from coal, consists of three separate and distinct processes: First, the *distillation* of the coal; second, the *condensation*, and third, the *purification* of the gas. The *distillation* is accomplished in clay retorts (*C*), which are set in brick-work, and of which five, six or more in number make a bench. These retorts are heated by a coke-fire placed beneath them. Into each retort 200 to 300 pounds of bituminous coal is put, then the mouth of the retort is securely closed by a lid which is held tightly in place by a screw, besides having the joint between it and the mouth-piece of the retort sealed by a luting of clay. When the process of distillation is at an end these lids are removed, and the coke within the retort is taken out, and after cooling, is sold for fuel or utilized in heating the retorts again. The temperature to which the retorts are heated is very high, sometimes as high as 2,370° Fahr., which brings them to a white heat. The coal within the retort is not exposed to so high a temperature, that being from 1,500° Fahr. to 1,600° Fahr. It has been found that about four hours is the proper length of time to continue the distillation, in order to produce the best results, and this, therefore, is the usual time which elapses from the closing of a retort until it is again opened. During the distillation, the gas which is driven off from the coal within the retorts is conveyed through the standpipes to the hydraulic main. This constitutes the second step in the process, and is the beginning of the *condensation*, or the removal from the gas of the water, the tar and all other substances which have come off with the gas which can be condensed. The hydraulic main (*B*), in which this condensation occurs, is a large pipe running the length of the benches and on top of them, and contains the condensable matters in the gas. When the fluids in the main reach a certain height they overflow into the tar well. From the main the gas passes to the exhauster, which is a pump drawing the gas from the main and forcing it to the condensers, or in some gas-works to the scrubbers first.

The condensers (*D*) are a series of iron tubes which are kept cool by being bathed in water. As the gas passes through these tubes the tar and ammonia-water are separated and are discharged into receptacles (*E*). The scrubber (*O*), into which the gas next passes, is a large iron cylinder containing brushes, stones, and other materials, so

arranged as to break up the spray of water which is discharged into it, with which the gas is still further deprived of its tar. From the time that the gas enters the hydraulic main until it reaches the stage we have just described, it is constantly losing its impurities. There still remain, however, several of the most important of these, which, unless removed, would render the gas totally unfit for use within the dwelling. These are sulphuretted hydrogen, carbonic acid and certain compounds containing sulphur and ammonia. The objection to sulphur is that in burning it becomes converted into sulphuric acid, and where this takes place to any extent injury may result to the bindings of books and to other materials. This does not occur to any appreciable degree in this country, so far as we have been able to ascertain, although in London, Manchester and elsewhere, it seems to have been recognized. Metallic substances, as for instance, the gas-fixtures and stop-cocks may be corroded if ammonia is present to any extent, while the carbonic acid not only is an objectionable ingredient on the score of health, but is also an actual injury to the illuminating power of the gas, reducing it five per cent. if present in the gas to the amount of one per cent. The object of purification is to remove these impurities from the gas before it is distributed to the consumers.

Purification of the gas may be effected in four different ways: 1st. By wet lime. 2d. By dry lime. 3d. By hydrated-sesquioxide of iron, known as the Laming process. 4th. By bog-iron ore, known as the iron ore process. In the wet lime process the gas passes through milk of lime and the carbonic acid and the compounds of sulphur are effectually removed. This is the oldest method of purification, and one of the best, but it is not now much employed for the reason that when the lime is removed from the purifiers (*M*) the odors which escape are extremely offensive and cause serious complaint from the residents about the gas-works. The dry lime process, in which the gas is purified by dry or slightly moistened hydrate of lime, is subject to the same objections; but by a device which is now in use in many of the works, the gases which prove so offensive when passed into the air are drawn off from the lime, and after being washed and purified are then permitted to escape into the air in an unobjectionable condition. In the Laming process, hydrated-sesquioxide of iron artificially prepared, with sulphate of lime and sawdust, is substituted for the lime. In the iron ore process, bog-iron ore, a native hydrated-sesquioxide of iron, is used in place of the artificial product of Laming. The object of all these processes is the same, namely, to form compounds of the

lime or the iron with sulphuretted hydrogen, carbonic acid and other impurities, so that when the gas leaves the purifier it shall have been deprived of these objectionable ingredients. That process will therefore be adopted which, in the best and most economical manner, accomplishes this object. As has been already said, the wet lime process is seldom used. In Europe the dry lime process is not employed, while in this country it is the one in general use, though at some of the works native iron ore is used. The gas of Paris is purified by the artificial hydrated-sesquioxide of iron. In Germany the iron ore process is the one generally adopted, as is the case in Liverpool and in some of the London companies.

Composition of Purified Coal-Gas.—The analyses of purified illuminating coal-gas vary considerably. The following is an analysis by Prof. Ira Remsen, of Johns Hopkins University, of the gas used in the city of Brooklyn, and may be considered a fair average:

	Per cent.
Carbon dioxide (Carbonic acid)	0.0
Illuminants (ethylene, &c.)	4.3
Carbon monoxide (Carbonic oxide)	7.9
Hydrogen	50.2
Marsh-gas	29.8
Nitrogen (by difference)	7.8
	100.0

MANUFACTURE OF WATER-GAS.

The principle upon which this method of making illuminating-gas depends is that when steam is passed over incandescent carbon, it is decomposed, the hydrogen being set free, and the oxygen uniting with the carbon to form carbonic oxide and carbonic acid. In order to enrich the gas it is treated with naphtha. There are several processess by which illuminating water-gas may be manufactured; the one which we shall describe is that of Tessie du Motay.

Gasogens.—These are two vertical iron furnaces lined with fire-brick, and separated from each other by a partition in which are the pipes in which the steam made in steam-boilers is superheated. In the furnaces themselves anthracite coal is put, and an intense heat generated by passing an air-blast through the coal. When the temperature is sufficiently high the steam is decomposed, and the resulting gas is stored in holders. Each gasogen holds about ten tons, and every hour not far from 1,000 pounds of coal is introduced. It is

estimated that one ton of coal will produce 45,000 feet of water-gas. The coal is only partially burned, and is again used in making steam.

Carburetters.—From the holders the gas passes to the carburetters. Each carburetter is a closed chamber, surrounded by a hot-water jacket. Inside is a series of pans, arranged one above the other and connected by pipes. Naphtha is introduced at the top of the carburetter, and after partially filling the first pan flows through the pipe into the second, which it also partially fills, overflows this, and so continues until all the pans are filled. The gas is admitted at the bottom of the carburetter, and passing through the same overflow pipes takes up the naphtha, the vaporization of the naphtha being greatly aided by the heat of the hot water in the jacket. The temperature of this water is 175° Fahr. Five gallons of naphtha are sufficient to enrich 1,000 feet of gas.

Fixing the Gas.—In this process the vapor of the naphtha is converted into a higher and more stable hydro-carbon compound. This step is exceedingly important, for without it the naphtha vapor would separate from the water-gas by condensation as soon as the temperature was lowered. For the fixing of the gas it is passed through long retorts, eighteen feet in length, which are heated by fires beneath. In these retorts are perforated partitions, which serve to break up the current of gas and to arrest the lampblack which is formed. From the retorts in which the gas is fixed it passes to the hydraulic main, condensers, scrubbers and purifiers, as in the process already described in the manufacture of coal-gas, lime being used for purification.

Composition of Purified Illuminating Water-Gas.—As was said of coal-gas, so it may be said of water-gas, that the analyses of the gas produced by the different processes and at the different works vary considerably. The following is the analysis, by Prof. Remsen, of the gas manufactured in Brooklyn by the Tessie du Motay process:

	Per cent.
Carbon dioxide (carbonic acid)	0.3
Illuminants (ethylene, &c.)	12.85
Carbon monoxide (carbonic oxide)	28.25
Hydrogen	30.3
Marsh-gas	21.45
Nitrogen (by difference)	6.85
	100.00

After purification the gas, by whatever process produced, passes through the station meters, where its amount is registered, and then into the gas-holders, where it is stored, and from which it is distributed to the consumers. The gas-holder (*G*) is a familiar object in all gas works. It is a large iron cylinder, which floats in water, and into which the gas passes from the purifiers. It is suspended in such manner that as the gas enters it rises, and falls as the gas is consumed. It is so weighted as not to exert a pressure on the contained gas to exceed that of a column of water six inches in height. The largest one in the world is now being constructed at East Greenwich, London. Its diameter will be 250 feet, and its capacity 8,250,000 cubic feet. From the holder the gas passes through a governor or pressure-regulator, which, as its name implies, regulates the pressure of the gas as it passes into the mains. The mains are cast-iron pipes, laid three feet under the ground, made in lengths usually of twelve feet, and leaded at the joints. That there is always some leakage of gas from these pipes is shown by the fact that whenever the streets are dug up in which gas-mains are laid, the earth is found to be impregnated with gas, which is readily recognized by its peculiar odor. The amount of this leakage is placed by the companies as high as ten per cent., though some regard it as amounting to fifteen per cent. Experiments are now being tried of substituting wrought-iron mains for those of cast-iron which are now in use, with the idea of reducing if not entirely abolishing this leakage, and also of reducing the size of the pipes and greatly increasing the pressure, a six-inch wrought-iron pipe being expected to do the work of a sixteen-inch cast-iron one. From the mains the gas is conveyed into houses through wrought-iron service pipes. At the point where the service pipe passes into the house is usually located the house meter, through which the gas passes to the consumer and in which, while it is passing, its quantity in cubic feet is measured, and a record thereof made on the dial.

When illuminating-gas was first introduced meters were unknown, and the consumers were supplied by contract, paying according to the number of burners and the hours during which gas was burned. The gas company turned the gas off and on at stated times, so that if light was wanted in the interval, lamps or candles were resorted to. In 1815 the first meter was invented, and from that time until 1833 a number of improvements were made. In the latter year Bogardus, an American, invented a meter which has served as a pattern for all the dry meters now in use. There are two kinds of meters now generally employed, the wet meter and the dry meter.

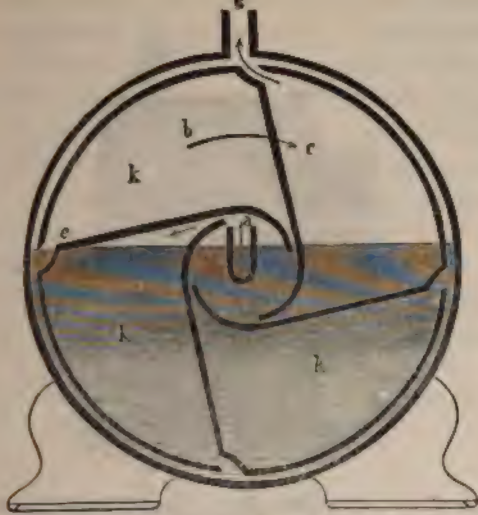


Fig. 3. Vertical section of the early wet meter. The gas enters the chambers k at the center through the tube a and passes out through the slits e on the periphery of the drum, escaping at the outlet g.

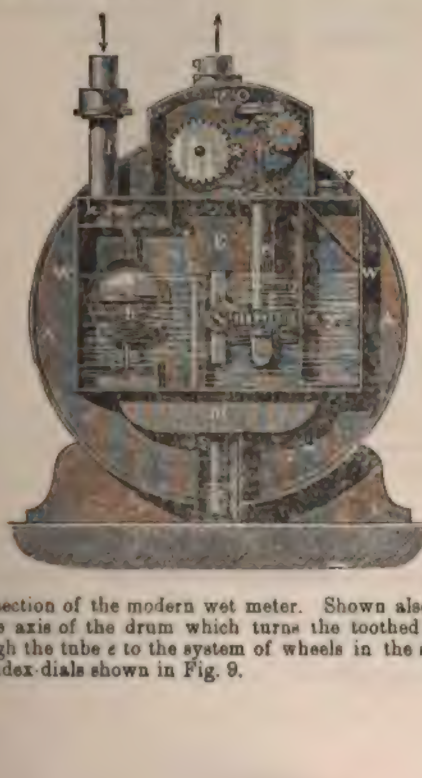


Fig. 4. Front section of the modern wet meter. Shown also in Figs. 5 and 6. a is the screw on the axis of the drum which turns the toothed wheel a, the axis of which passes through the tube e to the system of wheels in the space F which moves the hands on the index-dials shown in Fig. 9.

Fig. 5. Section of the modern wet meter. Shown also in Figs. 4 and 6. The gas enters by the inlet-pipe *l* to the space *k*, passes through the valve *i* to the space *E*, through the tube *n* to the space *B* of the drum, through the inlet slits to the measuring chambers, thence through the outlet slits to the space above the water-level *W*, and through the outlet pipe *q* to the burners. The tube *n* serves also as an overflow, and carries the excess of water to the waste cistern *m* (Fig 6). *W* is the water-level regulated by the overflow-tube *n*. If the level falls the float *h* drops and closes the valve *i*, preventing the passage of gas through the meter.

Fig. 6. Section of the modern wet meter, shown also in Figs. 4 and 5, and described under Fig. 5.

The Wet Meter (Figs. 3, 4, 5 and 6).—This meter is so called because water is necessary for its working. It is a metal box with a drum inside, divided into four chambers. This drum revolves in a cistern of water of sufficient depth to keep the drum about three-fifths submerged. The gas enters at one side and escapes at the other; its entrance causes the drum to turn upon its axis, and by means of gearing this motion is communicated to the dials, which register in cubic feet the amount of gas passing through the meter. One of the objections to the wet meter is the liability of the water to freeze. This can be prevented by placing it so that it will not be exposed, or by protecting it by means of thick cloth or felt, or by substituting for the water some fluid which will not freeze, as glycerine or a solution of chloride of calcium, four pounds being dissolved in a gallon of water.

Fig. 7. Side view of the measuring chamber of a dry meter. The case is divided by the partition *P* into two independent compartments; in each of these is a flexible chamber formed by the rings *rr*, the disks *dd* and the leather belts *ll*. Each disk is supported and kept in the same plane in its motion, by means of the horizontal arm *s* (Fig. 8), and the guides *gg*. The rods *hh*, bearing the arms *ss*, pass through a stuffing-box into the upper chamber *C*, and bear horizontal jointed levers, giving motion to the slide-valves which regulate the flow of gas into the various compartments, and also working the system of toothed wheels which record the quantity of gas passing through the meter on index-dials.

Dry Meter (Figs. 7 and 8).—These are made some with two and some with three compartments, each compartment being divided by a flexible diaphragm. The two diaphragm meter was invented by Croll and Richards, and the one with three diaphragms by Defries. In the working of the meter one-half of the chamber is filling with

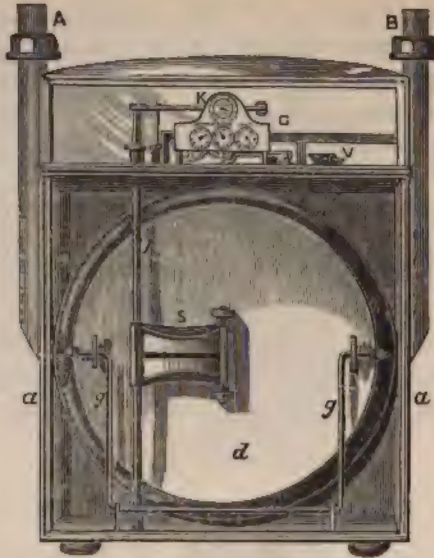


Fig. 8. Front view of the dry meter. *A* is the inlet, *B* the outlet. The gas enters at *A* passes to the valve-box *V*, enters the space *2* (Fig. 7), and the left hand chamber *lr*, while its pressure forces the gas out of the spaces *3* and the right-hand chamber *rl*. When the left hand chamber is full and its companion empty, the slide-valves reverse the flow of gas, and the empty chamber and the space *3* receive, while the full chamber and the space *2* deliver gas.

gas while the other is emptying. By the movement of the diaphragms and levers connected therewith the quantity of gas is measured on a dial as in the wet meter. Wet meters are very simple in their construction, and for this reason are preferable to the dry meter, into the construction of which a great many parts enter, but their liability to freeze, and the irregularity in their movements when there is too much water or too little, have caused them in many places to be superseded by the dry meter. It occasionally happens that the dry meter fails to move; this is especially liable to occur if a house has been unoccupied for a considerable time and the gas consequently not used, the valves in such case not working freely. The method of construction of these meters is shown in the accompanying illustrations. In the index (Fig. 9) the top dial, which indicates feet, is used only when the meter is tested. In the figure the reading would be 89,300, indicating that that amount of gas in cubic feet had traversed the meter. By taking readings of the index at different times the amount of gas which has been consumed in the intervals can be readily ascertained.

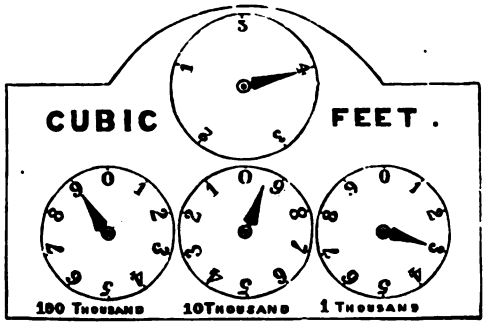


Fig. 9. Index of a dry meter.

MANUFACTURE OF AIR-GAS.

This gas is employed for lighting dwellings or other buildings in localities where there are no gas-works, and when gas is preferred to lamps or other means of illumination. This gas is a mixture of air and the vapor of gasoline, one of the products of the distillation of petroleum. The apparatus for its manufacture consists of a blower and a generator. (Fig. 10.) The generator is placed in a brick vault at a distance of about one hundred feet from the building. Gasoline is a very inflammable liquid, and is also so volatile that at ordinary temperatures it gives off vapors which, mingled with air, form an explosive mixture. That properly managed these machines are safe seems to be well established, the thousands of them in use at the present time being sufficient proof of that. The gasoline is transferred from the barrels in which it is purchased to the generator. Within the dwelling is the blower or air-pump, which is moved by a suspended weight. The air is forced by this blower into the generator, where it takes up the gasoline vapors, and is in that condition returned to the house where it is to be consumed. The evaporation of the gasoline in the generator lowers the temperature, and this retards the evaporation, and consequently depreciates the light. In order to avoid this in some of these machines, there is a device by which the generator can be warmed. Prof. Chandler tested the gas from a number of these machines, and found it to vary from 10½ to 30 candles.

We have now given the principal kinds of gas in general use in this country, but have not described them all for want of space. From 1824 to 1828 the New York Gas Light Company supplied its customers

with gas made from oil. For this purpose kitchen grease and other cheap varieties of fat were utilized. The melted fat ran into heated retorts where it was decomposed into gases consisting of hydrogen, marsh-gas, olefiant-gas, etc. Oil-gas is very rich in illuminating

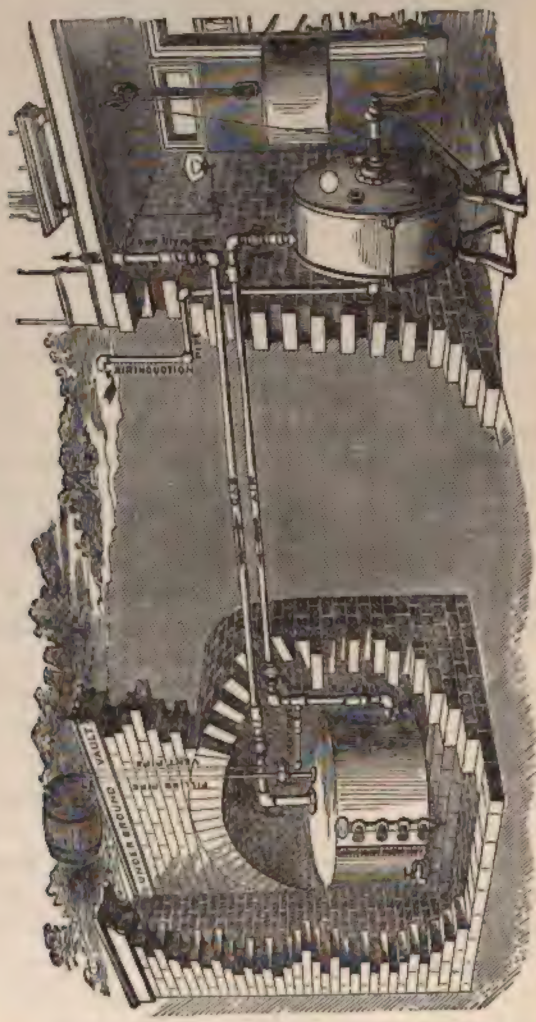


Fig. 10. Domestic gasoline apparatus.

properties. From one gallon of oil from 80 to 100 feet of gas can be obtained. The company to which we have referred sold the gas at the rate of $10 per 1,000 cubic feet. From 1828 to 1848 this same company changed its process of manufacturing illuminating-gas, using

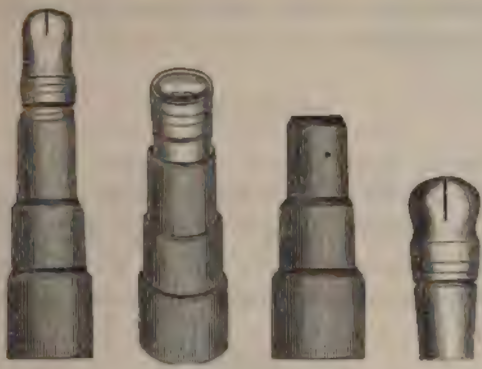


FIG. 11. FIG. 12. FIG. 13. FIG. 14.

Fig. 11. Seven-foot bat-wing, lava tip, mounted in pillar. The bat-wing burner is so called from its fancied resemblance to the wing of a bat. Inasmuch as the flame from such a burner extends so far laterally, there is always danger of cracking the globes if this pattern of burner is used.

Fig. 12. Six-foot fish-tail, lava tip, mounted in pillar. The fish-tail burner is so constructed that the flame, like the fish's tail, from which it derives its name, is fluked and does not spread so much laterally, and can be used with globes without danger of breaking. Its upper edge is irregular, and it is therefore not so symmetrical as that of the bat-wing. While this is true of the older form of the fish-tail, it is not true of the more recent form, as for instance, that of the Bray burner. This is spoken of by the inventor as a union jet rather than a fish-tail. And the openings are so arranged as to produce a perfectly symmetrical flame which has all the advantages of the bat-wing and fish-tail, and can be used with safety with globes. The combustion in this flame seems to be more perfect than in either the bat-wing or the ordinary fish-tail, though less so than in the argand.

Fig. 13. Brass pillar for tips.

Fig. 14. Seven-foot bat-wing, lava tip.

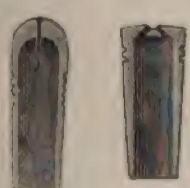


FIG. 15. FIG. 16.

Fig. 15. Four-foot bat-wing, lava tip.

Fig. 16. Two-foot fish-tail, lava tip.

resin instead of oil, the methods differing but little. For this gas $7 was charged per 1,000 cubic feet. In the latter year coal was substituted for resin, and the price fell to $2.50. Some gas companies

have used wood from which to produce their gas, subsequently enriching it with naphtha.

CANDLE-POWER.

The illuminating power of gas is designated by being of so many candle-power. By this is meant that a burner consuming five feet of gas per hour, the pressure being 0.5 inch, gives the same light that a given number of standard candles would. The candles employed for the test are of spermaceti, and burn two grains, as nearly as possible,

Fig. 17. Gleason's noiseless argand burner, of brass, with valve.

per minute. The instrument by which the comparison is made is called a photometer, that of Bunsen, or a modification being generally employed.

FIXTURES AND BURNERS.

The variety of gas fixtures and burners in the market at the present time is very great, and if a description should be attempted of them all, more space would be required than is at our disposal. We shall therefore limit description to those which are in most common use, or which, for one reason or another, have points of special merit. All gas-burners may be said to be modifications, in one or more particulars, of three types—1, *the bat-wing* (Figs. 11, 14 and 15); 2, *the fish-tail* (Figs. 12 and 16), and 3, *the argand* (Figs. 17 and 18). *The bat-wing* (Figs. 11, 14 and 15), is a burner in which the opening in the tip through which the gas escapes is a simple slit. The *tips* are made of different materials. Sometimes they are made of so-called lava, which is really steatite or soapstone, and sometimes of metal.

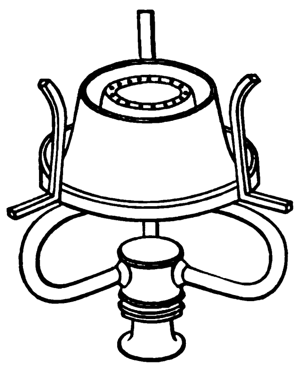


Fig. 18. Sugg's London argand, lava.

Nickel tips are now being used to a considerable extent. Iron tips are also in use, but are liable to become corroded. By making this slit narrower or wider in the manufacture, by using a thinner or thicker saw, the quantity of gas which is burned will be smaller or larger. A slit which will emit three feet of gas per hour is known as a three-foot burner, one that emits four feet, a four-foot one, and so on. (Fig. 19.) Of course the amount of pressure under which the gas is admitted to the burner will materially affect this, and the

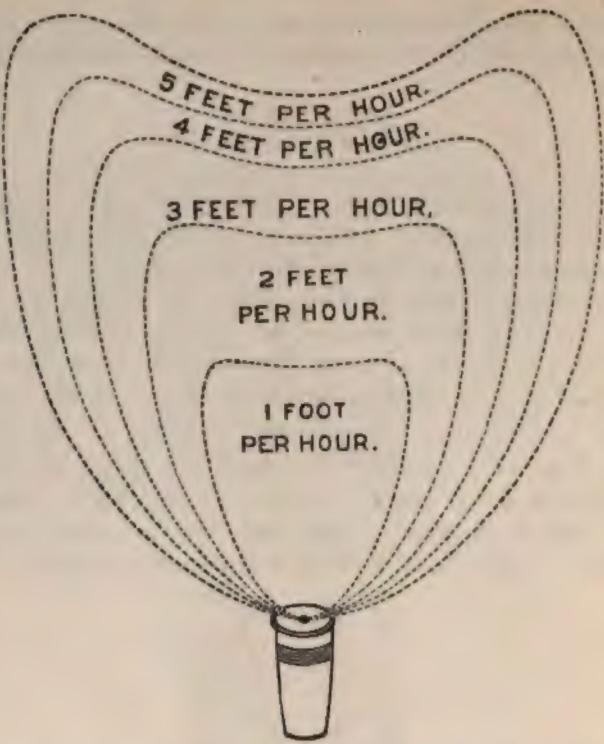


Fig. 19. Forms and sizes of flames from a five-foot fish-tail, lava tip burner.

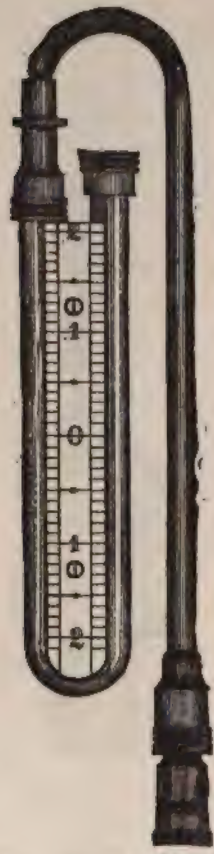
standard is one inch. That is, a three-foot burner will emit three feet of gas per hour when the gas is under a pressure of one inch. If the pressure be greater than this the amount of gas will be increased and *vice versa*. The tips are usually distinguished by the number of rings upon them, but this is a very unreliable guide. There is a *pocket test meter* (Fig. 20) which can be employed by any one, and which, while it is not absolutely accurate, still gives an approximate estimate of the amount of gas emitted from the burner upon which it is placed. The cost of this is $3. A *gauge* (Fig. 21) can also be obtained for $2, with which any one can ascertain the pressure at any burner by simply unscrewing the burner and substituting the gauge. Some varieties of gas, as for instance, the water-gas, produce so much heat that lava tips are liable to split and break; the use of the nickel tips overcomes this difficulty. The second type of burner is the *fish-tail*. (Figs. 12 and 16.) The tip of this burner is perforated by two

Fig. 20. Gleason's pocket test meter.

holes which face each other, so that the gas when it emerges comes out in two streams which strike against each other, and when ignited the resulting flame is not so spreading as in the bat-wing. When globes are used over the burner they are less liable to be cracked if the tip is a fish-tail rather than a bat-wing. The best burner of this kind that we have seen is known as "Bray's Special." It is of English make, and the tip, or rather what serves as a tip, is an enamel placed within the pillar, as the holder of the tip is called. The designations on these burners of "4 feet," "5 feet," etc., are very exact, as we have found by actual test, and the light is very soft and brilliant. For general use it seems to leave nothing to be desired where a fish-tail burner is preferred. These burners can be purchased for about ten

PRESSURE GUAGE.

(Urania.)



4 in...........	each,	$4.00
6 in...........	"	6.00
8 in...........	"	8.00

Fig. 21. Pressure gauge.

cents each. It is urged as an objection to the fish-tail burner that although it gives a very satisfactory light when new, yet after a time the holes become more or less filled with dirt which cannot be removed, and the flame is consequently affected. The bat-wing, on the other hand, if it becomes similarly obstructed, can be readily cleaned by a piece of metal known as a *burner-cleaner*, especially made for this purpose. (Fig. 22.) There are also cleaners for the

Fig. 22. Cleaner for bat-wing burners.

fish-tail burners (Fig. 23), but the obstructions are not so readily removed as in the bat-wing. The third type of burner is the *argand*. (Figs. 17 and 18.) This consists of a ring pierced with holes through which the gas escapes, and is so constructed that air is admitted both

Fig. 23. Cleaner for fish-tail burners.

outside and inside the flame, thus insuring more complete combustion and a better light. This burner requires a chimney, and although it gives a brilliant light is a great consumer of gas.

One of the best of these is the "*Silber-Argand*." Mr. Silber found as the result of a great many experiments that an excess of fuel over air produced imperfect combustion by lack of oxygen; while excess of air over fuel produced imperfect combustion by diminution of temperature. In either case the light would be diminished, and the injurious products of combustion which would be thrown into the air would be increased. With the idea of adjusting the air to the fuel he devised an argand burner made of brass and steatite, so constructed that two currents of air pass into the interior of the flame and two others on the outside. The opening by which the air is admitted is so adjusted as to cause the least consumption of the gas to produce the highest luminosity.

Another excellent argand is that of Mr. Sugg, commonly known as the *New "London" Argand*. (Fig. 18.) The body of the burner is supported on three tubes, by which it can be distinguished from other argands. "The combustion chamber in this burner is also made of steatite, and is pierced with holes so arranged as regards size and number that the quantity of gas the burner is required to consume shall pass out at an inappreciable or at the least possible pressure, in order that the oxygen of the atmosphere shall combine with the burning gas by natural affinity only, leaving the nitrogen to pass freely out at the top of the flame." Such is the description of this burner given by its inventor. A burner in general use in this country is the

"*Gleason's Noiseless Argand*" (Fig. 17), a regulator or governor being attached beneath the burner by which the amount of gas can be regulated according to the pressure.

The impression seems to be quite general that if gas can be heated before it is burned, its illuminating power will be greatly increased. The opinions on this subject seem to vary very much. Certain experiments performed at Munich resulted in an increase of 18 per cent. of the illuminating power when the temperature of the gas was raised from 64.5° Fahr. to 288° Fahr. In 1871, the London gas referees repeated these experiments, and reported that when the temperature of gas was raised from 69° Fahr. to 296° Fahr. they found no appreciable difference in its illuminating power. One of the referees has since performed the experiment again. He passed the gas through about six feet of copper tubing heated to dull redness, raising the temperature of the gas from 58° Fahr. to 350° Fahr. He completely confirmed the results obtained by the London referees, and reports that there is no appreciable difference in the illuminating power of the gas when so heated. Heating the air supplied to the burner increases its illuminating power about 9 per cent. for 450 degrees of temperature. The experiments which are here reported, and which seem to show that heating the gas does not increase its illuminating power, are not entirely in accord with some of the most recent experiments, notably those of Dr. C. W. Siemens, F.R.S., of London, and Herr F. Siemens, of Dresden, who have devised what is known as "*Siemens' Regenerative Gas Burner.*" This burner was constructed "with a view to the attainment of increased illumination, greater economy in the consumption of gas, absolute steadiness of light, perfect ventilation, complete combustion, and the utilization and disposal of the products of combustion." Of these burners R. B. Carter, F.R.S., says they are now in use at the eastern extremity of Holborn, "where they cast into comparative shadow the Edison electric light in the adjacent street." It would be impossible without a diagram to describe this burner so that it could be thoroughly understood. The principle on which it is constructed is that of heating the air and the gas before they unite, and this is accomplished by compelling the heat produced by the combustion of the gas to heat the air and gas which are on their way to the burner to be consumed. The temperature to which the gas and air are heated is 1,652° Fahr. Competent men have tested the illuminating power of the largest size of this burner, and

pronounce it greater than that of any other burner ever constructed. For street and other use, where a single light of such power is desired, nothing would seem to be better adapted, but for dwellings or rooms, where the smaller sizes would give all the light necessary, it is not much, if any, superior to some of the best argands, besides being very expensive.

Mr. Grimston, of England, has invented a burner which he claims will be available for both small and large spaces. It is described as practically an argand burner turned upside down, the flame curving round the margin of an inner cylinder, which contains the ring of gas tubes, and then ascending within an outer cylinder or chimney. The space between the two cylinders contains cross-tubes, which open into the external air by one extremity, and into the internal cylinder by the other, and which thus supply heated air to the flame. It is said

Fig. 24. Beacon bracket light.

of this burner that ten feet of gas per hour will produce a sixty candle-light, and that smaller burners will, in consuming a smaller quantity of gas, produce a light proportionately bright. We have never seen this burner, and know nothing of its practical working. There has been, however, recently produced in this country a form of burner whose claim for popular favor depends upon this superheating principle. It is known as the *Beacon Light.* (Fig. 24.) It consists of a tube which heats the gas in its downward passage to the burner, and the inventor claims for it great illuminating power. Had this been brought out some years ago, we should have felt like condemning its claim, on the ground of the results of the experiments of the London gas referees, already quoted, but the results reached by Siemens and Grimston are such as to make us hesitate before expressing an opinion on the merits

of these *superheating burners*, and we have not been able to carry out such experiments as to warrant us in either indorsing or disparaging them. One other claim which is made in this patent is the suspension of a shade or globe by its flange from above to avoid shadow underneath. This is in itself a great advantage, irrespective of the merits of the burner. These burners are being generally introduced, and give a very satisfactory light, though if they are placed too near the head the heat from them is objectionable. This, it is claimed, is overcome by means of a shade which is placed beneath the light.

Fig. 25. Albo-carbon light.

Another light which is quite popular is the "*Albo-Carbon.*" (Fig. 25.) Connected with the burners of this light is a reservoir, in which is placed naphthaline, a hydro-carbon which is white in color, and gives its name to the light. When the gas is first lighted there is no appreciable difference between this flame and an ordinary gas

flame, but in a few minutes the heat produced by the burning gas melts and volatilizes the naphthaline contained in the reservoir, and its vapors mixing with the ordinary gas greatly enrich it. The light produced is very steady and brilliant, and it is claimed for it by Dr. Carter that it not only, in round numbers, gives twice the ordinary illumination for half the amount of gas consumption, but that the light is of purer and better color than any other with which he is acquainted. The naphthaline is very cheap, and is now made in a very convenient form for handling, being moulded into pieces about an inch long, and of the diameter of a candle. This light will undoubtedly grow in popular favor. This light is in use in the city of Brooklyn, in the largest library in the city, and also in a number of large and long-established commercial houses, and appears to give satisfaction. The proprietors of one of the largest dry-goods houses in the city says of it: "The light is remarkably steady, of great brilliancy and intensity, and enables our customers to distinguish colors to an extent that before their use was almost an impossibility." In reference to the economy of this burner, the reports are very favorable. An architect of the city of New York told the writer that in a hall where these lights were now in use, the gas-bills had been reduced from $3.00 to 50 cents a month. When the reservoir which contains the carbon is opened for the purpose of refilling, there is an odor of naphthaline, which, however, seems not to be objectionable to those who use the light.

In reference to the use of *air-gas*, it need only be said that the ordinary burners are not well adapted for it, and that consequently special burners are provided; also, that higher chimneys are required than for ordinary gas, in order to prevent the flame from smoking.

The earlier burners were so constructed that whenever the pressure of gas was increased the flame would "sing" and flare up, and in order to avoid this it was necessary to turn the key so as to shut off the excess of gas. Under such circumstances the issuing gas would not be entirely consumed, and the products of the incomplete combustion would vitiate the air and smoke the walls and ceilings. This has been to a great degree overcome by introducing "*checks*" to the escape of the gas. These consist of wire gauze, pieces of cloth or other obstacle to the outflow of the gas, and are placed in the pillar, as the holder of the tip is called. In the *Empire burner* (Fig. 26) this result is obtained by an adjustable screw in which is a slit which can be

Fig. 26. Empire burner.

increased or diminished, so that a very small or a very large flame can be had at pleasure. While the pressure may thus be regulated at the individual burners, it is often desirable to be able to regulate it at the meter. For this purpose "*governors*" or "*gas regulators*" are employed. These are so constructed that no matter what the pressure may be in the street-mains, it is kept at a constant value within the house.

The use of *globes* to protect the flame from draughts is at the sacrifice of illuminating power. Even a piece of clear glass held in front of a flame will reduce the illumination one-tenth. Clear glass globes will, therefore, diminish the illuminating power of the flame. Experiments which have been made with these globes, has demonstrated that the one in which the loss is the least, is that having a lower opening of two and a half inches. With such an opening the reduction amounts to about eight per cent., while if the opening is but one inch, the loss is nearly twenty-nine per cent. In addition to this great loss when globes with small openings are used, the flame flickers. In order to have a steady flame the opening must be considerable, that of two and a half inches being well adapted to secure this object, although many of the globes now used have a lower opening of four or five inches.

ANNOYANCES AND DISCOMFORTS CONNECTED WITH THE USE OF ILLUMINATING-GAS.

Among the annoyances incident to the use of gas for lighting is that caused by the gas going out. This, in accordance with "the natural depravity of inanimate objects" is very apt to occur, if at all, at times when it is most inconvenient. It is related of Sir Walter Scott that when he first inhabited Abbotsford, which he had had fitted up with gas fixtures, he gave a house-warming, during which the gas went out leaving his guests in total darkness, but of late years such accidents are exceedingly infrequent.

In the article already referred to, Prof. Chandler gives the following instructions for guidance in such events. When the gas goes out in a house supplied through a wet-meter, it may be due to (1) a deficiency of water; (2) excess of water; (3) freezing of the meter; (4) freezing of the service-pipe; (5) condensation of water in the house-pipes. The best and safest plan is to send for a gas-fitter or to the office of the company; but as the difficulty is most likely to occur during the evening, when help can rarely be obtained, it is well to know how to meet the emergency. (1) Close the cocks of all the burners which are open, save one; (2) go to the meter with a candle, which must be held at a distance to avoid explosion; (3) turn off the gas at the main cock between the street service-pipe and the meter; (4) unscrew the plug *u* (Figs. 3 and 4) of the waste-water cistern, to let out any excess of water present; (5) unscrew the supply-plug *v* (Fig. 5) and the overflow plugs (not shown in the figures, the tube *n* serving as an overflow in this meter), and pour in gently a small quantity of water till it issues from the overflow or at *u*. When it ceases to flow, carefully replace all the plugs and turn on the gas, when the meter will be in working order. (6) If the meter is frozen, pour boiling water over it, and run a little hot water through the orifice *v*, letting it escape at *u*, or at the overflow. (7) A frozen service-pipe generally necessitates an excavation, and the application of heat outside the house. (8) Condensation in the pipes is first indicated by a flickering or jumping of the lights, due to the partial obstruction of the gas by the accumulation of water in the depressions in the line of pipe, which breaks it into bubbles. Removing a burner and blowing violently into the pipe will sometimes force the water beyond the hollow. This latter difficulty is, however, best removed by a gas-fitter, or by sending complaint to the

office of the company which supplies the gas. At the present time it is, herhaps, never necessary to dig up the street when the pipe freezes. Instead of this alcohol is poured into the pipe, and this forced in with a force-pump.

Another discomfort connected with the use of gas, which may also be regarded as a detriment to health, is the heating of the air, especially in the upper portions near the ceiling. That this is so to a very great degree any one can satisfy himself by standing on the upper steps of a step-ladder in a room in which gas has been burning for some time. In addition to this the injurious products of combustion accumulate as well as the heat, and the air becomes doubly deteriorated for purposes of respiration. In public halls, in some instances, provision

Fig. 27. Mica smoke catcher.

has been made for the escape of this heated and vitiated air through the ceiling, but in most buildings no such attempt is made. The *Hammond Globe-Light* and the *Siemens Regenerative Burner* are especially valuable as overcoming these objections to the use of gas. Still another annoyance is the smoking of walls and ceilings. This is, of course, due to the unconsumed carbon of the gas, and can best be avoided by the use of burners so constructed as to accomplish this; but it may also be avoided by the use of *Mica Smoke Catchers* (Fig. 27), which can be readily attached to the top of the globe, or if the burner

is an argand, to the top of the chimney. If, however, much smoking occurs, it is an indication that something is wrong, and that the pressure or the burners need regulating. The injury to the walls is of slight moment as compared to the injury to health which may be caused by respiring air vitiated in this manner.

INJURIES TO PROPERTY, HEALTH AND LIFE INCIDENT TO THE USE OF ILLUMINATING-GAS.

Gas may escape from the mains of the companies in the public streets and find its way into buildings and thus cause damage. In a case which occurred in Providence, gas passed from the main into the sewer, thence into a greenhouse connected therewith, and destroyed the plants contained therein. When the sewers were built the earth about them was not properly packed, and the subsequent settling made a leak in the gas pipes, with the result already described.

One of the commonest dangers connected with the escape of gas from the pipes is that of *explosion*. The mixture of atmospheric air and gas forms a most explosive compound, and if a light is brought in contact with it, an explosion is sure to result. In some cases this has been due to the escape of gas from the street-mains, and in some manner this gas has found its way into the interior of the building. Its odor being detected, some one has imprudently gone with a lamp or candle to ascertain the cause, and an explosion has resulted, sometimes doing injury only to property by shock or fire, and sometimes maiming and even killing the unfortunate investigator or others. We will relate a number of instances illustrative of this danger, which have actually occurred. In one case gas escaped from a broken main and found its way into an occupied house in large quantities. It then took fire and exploded, injuring two persons. In this case there was no gas used in the house. In another case a meter was removed, the workman neglecting to close the pipe. A man went with a lighted candle into the cellar where the meter had been, the gas and air exploded, and he was injured. In another case there was a settling of earth in the street, resulting in a break in the gas-main; the gas found its way into a vault in which tools were stored. The owner going into this vault with a light was severely and dangerously injured by the explosion which followed. In still another case, in which a service-pipe leaked, a servant, in searching for the leak with a lighted match,

caused an explosion which was so terrific as to destroy the interior of the house. A mother and her child aged seven years were blown up to the ceiling of a room on the first floor and fell through the broken floor, together with pieces of timber and boards, into the cellar. The child sustained a compound fracture of the thigh, and was confined to bed for three months.

The number of cases in which illuminating-gas has produced sickness and death by its *inhalation* are more numerous, perhaps, than by its explosion. In one case which occurred in Boston, the gas which escaped from the street and the next house found its way into the third story of an occupied dwelling, and on the following morning a child occupying a room on this floor was found nearly insensible, after having vomited from the effects of the gas. In another case, gas escaping from a street-main found its way through a sewer and drain into a tenement in which there were no gas-pipes. Several persons were made sick by it, and one died, the disease being a fever of a typhoid type. Numerous cases are on record where insensibility or death resulted from the *blowing out of the gas.* In most of these instances the victims have been persons unaccustomed to the use of gas, who were stopping for the night at some town or city hotel. In other cases the injury has resulted from *turning the stop-cock of the fixture too far.* In old patterns of fixtures there are no stops, and it is very difficult to turn such a stop-cock exactly at right angles; as a consequence, the gas escapes after it is extinguished. And in the modern gas fixture everything is made so light that there is but little durability. The pin which stops the key from turning too far is very slight, and gas-fitters are often called upon to replace them, so that the same accident is liable to occur with these as with the older patterns. Still another cause of accident in these cases, and one which occurs even with those who are perfectly familiar with the use of gas, is the *turning of the flame down,* so that but little gas is burned. Subsequently the pressure on the gas is reduced by the company at its works to such a point that it is not supplied to the burner in quantity to ignite, and the flame is extinguished; or a puff of air from an open window, or caused by the closing of a door, which would produce but a temporary effect on a flame of any size, striking on the reduced flame, puts it out altogether. The gas continues to escape during the entire night, and in the morning the occupant of the room is found insensible or dead. In some of these cases the deaths have been

suicidal. One is on record in which a man shut himself in an ice-box, and with him a rubber-tube connected with an open gas-burner. *Defective gas fixtures* have also been responsible for the death of human beings, the gas escaping from the defect. Death has also resulted from the inhalation of illuminating-gas which was used in a gas-stove for heating purposes, the stove being out of repair and not consuming the gas supplied to it.

The methods of avoiding most of these dangers suggest themselves after reading the accounts just given. We can of course do nothing individually to stop a leak in the street-mains, but we can, if any such come to our attention, notify the companies, who will be sufficiently interested to make the necessary repairs at the earliest possible moment. If the odor of gas is detected within the dwelling, no attempt should be made to discover its source with a light of any kind, for fear of explosion, until the apartment has been so thoroughly ventilated that no possible danger exists, and even then, if search can safely be delayed, it is best done by daylight. Under no circumstances should a lighted match, candle or other light be carried where gas has escaped, until the precaution to thoroughly ventilate has been taken. All the gas-pipes of a house should be thoroughly tested to be sure that they are tight in every part, and capable of retaining the gas within them under the greatest pressure to which it is liable to be subjected. At the present time no municipal government is complete without departments properly organized for the inspection of the walls and beams of buildings as to their strength, and the sewer and drain-pipes as to their ability to exclude sewer-air. Similar inspection should be made of the gas-pipes before a building is occupied, and from time to time thereafter, to insure tightness of joints and soundness of fixtures. For hotels, boarding-houses and other similar places, more reliable and better-constructed stop-cocks should be required. Stop-cocks should be so made that it would be impossible ignorantly to leave them open so that gas could escape. This would perhaps be best accomplished by constructing the cocks on the principle of steam-valves or air-cocks, so that when the gas was turned off and extinguished, it could not again be turned on again without reversing the motion. If the present pattern of cocks are to continue in use, their checks or stops should be made of such size and in such manner that when the light is extinguished one could be sure that the gas was completely shut off, although the room was so dark that one could not see. And these

precautions should not be left to the discretion or choice of the householder, but should be regulated by ordinance. All fixtures should be similarly tested, and repaired or discarded if found defective. Those not provided with stops in which the cocks can be turned all around should not be used at all. Gas should never be turned down to a small flame and thus left. This is a common practice in households where there are children, after they have been put to bed, and it is also done by adults throughout the entire night. It is not only a dangerous practice, but is also an objectionable one on other grounds. Perfect rest can only be obtained in the absence of noise and light. If a light is burned all night the sense of sight is affected by it, and the sleep will be disturbed by dreams or otherwise; the same will happen if there is not absolute quiet. For the best interests of health, both in children and adults, the sleeping-room should be dark.

In the preparation of this paper the following authorities have been freely consulted:

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Medical Physics, Draper.

Report of the Commissioner of Health on Illuminating-Gas, Brooklyn, 1883.

The chapters on "Lighting," by Dr. Carter, are admirable in every respect. They not only treat of illumination by means of gas, but by electricity and oil as well, and deal also with the physical nature and physiological effects of light and color, of natural light and windows, and of the regulation and control of daylight illumination. The article on Gas Lighting, by Prof. Chandler in Johnson's Cyclopædia, is the best general article we have been able to find upon the subject, and the illustrations, Figs. 2 to 19, with one exception, have been furnished by the publishers of that Cyclopædia. The illustration of the candle-flame (Fig. 1) is from Draper's Medical Physics, and is furnished by the publishers, Messrs. Lea Brothers & Co. This is the best book for study and reference on the subjects of which it treats with which we are acquainted. The illustration of the gasoline apparatus is from the 3d vol. of the American Supplement to the Encyclopædia Britannica, published by Messrs. Hubbard Brothers.

Fig. 25 was supplied by the manufacturers and proprietors of the Albo-carbon light. The other illustrations, Figs. 20 to 27, have been loaned by Mr. Albee, secretary of the E. P. Gleason Manufacturing Company, of New York. We desire to extend our thanks to all of the above for the interest they have shown in aiding in the preparation of this article.

Our thanks are also due to the officers of the Fulton Municipal Gas Light Company, of Brooklyn, and the Brooklyn Gas Light Company, for facilities offered by them, and to Messrs. James J. Powers and G. F. F. Williams, of Brooklyn, for assistance rendered in experimentation.

THE RELATION BETWEEN DRINKING-WATER AND TYPHOID FEVER.

BY DOWLING BENJAMIN, M.D., OF CAMDEN, N. J.

Typhoid fever is caused by a peculiar and specific poison. I do not know that this is denied to-day by any one competent from careful study and thorough investigation to give trustworthy information on this subject. Does it arise *de novo?* All the investigations that I have made have proven to my mind that the poison which produces typhoid fever cannot be generated spontaneously, but must come from another case. I am aware that there are some physicians who even now believe that it originates *de novo*, and they give the examples and cases which prove to their minds the truth of such belief. But the cases cited as proofs, in my opinion, are generally defective, and do not exclude the possibility of infection from a preceding case.

What are the physical characteristics of the virus of typhoid fever? Is this virus a liquid, a solid, or a gas? Evidently it is matter of some kind. Inorganic matter may be either solid, liquid or gas; organized matter is never liquid, never gas. We conclude it is not a gas, for the following reasons:

First. The gas has not been isolated.

Second. It would be more apt to go through the air than otherwise, which is not the case with this virus.

Third. All known gases that affect the system profoundly, or that affect the system at all, do so at once, or in a few minutes after their reception into the system.

Can a dose of carbonic-gas, ammonia-gas, illuminating-gas or any other poisonous gas be taken and lie in the system for from two to six weeks and then begin to develop a train of trouble—a uniform succession of symptoms, like typhoid fever, or small-pox or any other of the zymotic diseases? Never. Is it a liquid—this virus? The same objections apply to this theory that apply to the theory of its

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acter of the dejecta is not destroyed by freezing, but is only kept in a state of hibernation. A great part of the three months' accumulation of dejecta was suddenly swept into the rapidly running stream, and reached the lower reservoir as quickly as a man walking fast could have arrived there.

"In fifteen days from this time the epidemic began, fifty cases occurring daily between the tenth and twentieth of April. Up to the present twelve hundred have been sick, and one hundred have died, out of a population of eight thousand. For the first three weeks the few people in the town who used well-water exclusively escaped the disease. The period of incubation varies between ten and twenty days, or longer, and therefore no other conclusion can be arrived at than that the infective poison existed in the mountain water, and originated from the one case of fever in the house on the side of the stream."

This entire and comprehensive report is on file in the mayor's office, Philadelphia.

Last October a severe epidemic of typhoid was in progress in Imlaystown, N. J., about 40 miles from Camden, and I went out there to investigate it, and was greatly assisted in so doing by the kindness of Dr. H. G. Norton.

I found that a brook about 4 feet wide runs through the village. A street runs parallel with the stream, about 100 feet from it. A row of houses is situated between the brook and street, and the back-yards extend to the brook, about 40 feet distant. Between the brook and the houses is situated a row of privies, and a row of wells for drinking-water. The privies are situated on the bank of the brook, so that the fecal matter from them has to run only a distance of only 3 or 4 feet to get into the stream. The wells are between the stream and the dwelling-houses, and about 30 or 40 feet from the brook. The somewhat impervious strata has a slight dip towards the wells and underlies the locality. On measuring it was found that the floor or bottom of the wells was not more than a few inches below the floor of the brook, and when the water was high in the brook it was also high in the wells. The soil between the brook and the wells of the privies was porous.

Beginning up the stream and designating the houses, which are but a few feet apart—not over 50 feet—and numbering them one, two, three, I will give you the following explanation:

In 1883 a family came to number *one*, suffering with typhoid-malarial fever and diarrhœa. The children had fever and bowel trouble,

with diarrhœa, lasting for months, until the spring of 1885. On August 14th, 1885, a young lady was taken with typhoid fever in this same house. On August 28th, another young lady was taken with the disease in number two, the next house below—down the stream. August 27th, a patient at number three took the disease. September 12th, another patient took the disease in number three. In September, a relative of the family in number *two* visited the town, drank the water, and died in a few weeks afterwards of typhoid fever. September 30th, a patient opposite to number two took the disease. In the spring of 1886 the family had moved out of number two, the well had been kept closed and had not been cleaned out. A new family moved in number two in April or May, 1886. The boys drank the well-water, in spite of protests, and took the disease in June, 1886. One of the brothers died. The girls, who would not drink the water, escaped the disease.

An analysis of this water from the wells, for the State Board of Health, by Professor H. B. Cornwall, of Princeton College, showed the water to be thoroughly contaminated with organic matter. Evidently the virus had remained in one of these wells; a year had passed and yet the winter had not been able to kill it.

The length of time that the virus will remain active has not been ascertained, but it is known to be years in water that is not much disturbed.

I have cited these examples because they are so recent and so near at hand. Hundreds of instances might be cited, and the evidence piled up almost *ad libitum*, but, if further examples would not be superfluous in this paper, the time allotted to me would preclude my citing them here. I might say now that much of the data upon which my remarks have been based is not included in this paper for the same reasons.

In the face of what is already known, I do not think that any student of sanitary science can deny that the poison of typhoid may be carried by the water-supply. I do not know that any do deny this, but the *extent* to which it is carried by water, and the preventability of the same, are the great points that do not seem to be sufficiently appreciated by us, and scarcely appreciated at all by the people in general.

If the people can be made to understand that almost all the cases of typhoid fever come from the water-supply, and that there is no

disease more easily prevented than this, we shall have accomplished the first great step towards the annihilation of one of the worst destroyers of mankind.

Look at the dreadful suffering caused in Philadelphia and Camden to-day by ignorance or indifference to these facts. Only a few days ago a noble wife and young mother died in our city of this dread disease, thus blighting the prospects of a happy family, and as I stood by her bedside I could but regret that another valuable life had been needlessly sacrificed.

The city of Camden had connected the water-closets and sewers containing the poison with the water-supply, and then distributed it thus laden with the deadly virus to the inhabitants of this city but a few hours after it had left the sewers. The husband of this lady "as a lamb dumb before its shearers, opens not its mouth," so he paid his water tax to the city, his wife drank the dearly-bought "distillment" and gave up her life as the result.

Is there no redress? Is there no hope of escape for the people in these great cities? Must they continue to die by hundreds, as the death returns show every year, at a greater cost and expense than pure water could be procured for? Philadelphia also pours the poison into the cup and then puts it to the lips of her citizens, and kills off about 700 of them a year, according to the official report.

The disease cannot occur without the virus to produce it, and the virus can be kept out of the drinking water, and it should be kept out at any cost. It would pay at *any* price. Every death that is preventable is needless, and is a reproach to the community. Dr. E. O. Shakespeare, an eminent investigator of contagious diseases, who has been sent abroad by the highest executive authority of the United States to investigate the nature and causes of cholera, says, in the "New York Medical Journal," January, 1885, "that epidemics of typhoid fever are absolutely preventable and controllable, and neglect to employ proper means to this end should be regarded as inexcusable."

Great reforms and revolutions have taken place within our own recollection, and the student of sanitary science fondly dares to indulge the hope that even during his short life he may have the pleasure of seeing the death-rate from typhoid fever reduced more than 90 per cent.

ROADS AND STREETS AS SANITARY MEASURES, AND HOW TO CONSTRUCT THEM.

BY C. PHILLIPS BASSETT, C.E.E.M., NEWARK, N. J.

The problems at present demanding solution are those which affect our social relations. Every year adds to their complexity. Prominent among these are questions relating to roads and streets. Arteries and veins hold no more vital relation to our lives than public highways sustain to the body politic. The importance of the subject in hand is therefore apparent and pressing. But there is prevalent a general and persistent indifference to the conditions of the public roads and streets. This is the more formidable since it is not recognized. The ignorance on which this indifference is founded, exists not only among the general public, but among many who should be technically conversant with the advantages of proper roadways and the methods of securing them. There is wide need for greater light on this subject. There are many communities in the State constantly wasting money in foolish or incomplete construction, and there are others which with equal folly refuse, on the ground of economy, a fair outlay to put the roads and streets in even decent condition, and keep them so.

I cannot fail to feel a deep regret that the limited space at my command prevents adequate treatment of a matter of such importance to the entire State. The uses of roads and streets are so general, and affect so intimately our existence, that we may expect to find them exerting a potent influence as sanitary measures. Yet it must be admitted that the element of sanitation is given little, if any, weight, in determining present practice in the State.

Financial considerations will continue to exert the chief weight in determining public policy, even in the face of sanitary disadvantages; it is therefore thought wise to show that in many instances the two may go hand in hand. The presentation of the economics of the question may present attractions which will result in securing benefits

of importance to the public health. It seems necessary in the present condition of public opinion to demonstrate the first to secure the second. The time will come when questions of public health will not be conditioned on penurious economy.

So far as the limits of this paper will permit, the subject will be considered under the following heads:

1. The advantages of properly contructed (*a*) country roads, (*b*) county roads, (*c*) village, town and city streets; 2. Outline of the methods of construction; 3. Maintenance; 4. The conditions to which the different systems of construction are best adapted.

I realize that in thus planning the paper, I have outlined a work which might readily occupy a treatise, but the comprehensive character of the subject alloted me seems to require broad and general treatment. I shall feel satisfied if this paper secures merely a recognition of the importance of the subject with which it deals. More complete details may be developed for particular cases requiring professional attention.

COUNTRY ROADS.

The sanitary advantages of country roads, when properly constructed, are somewhat indirect, but are powerful, and reach out in their influence to distant populations. Many people seem to take it for granted that because they have been accustomed to travel over muddy, crooked and steep roads, they need no change; and broad-minded men follow in their steps only from an unwillingness to endure the abuse and trouble necessary to secure the needed improvements. How often have we seen team and driver laboring, worrying or swearing (these are not sanitary conditions) along a muddy road when excellent material for road making was available, tantalizing in its proximity and ease of procurement. Considering the advantages of good roads in point of travel, it is amazing that material furnished so lavishly by nature should be so little used. Country roads are frequently made by scraping sods and dirt into the wagon track to be worn down as best they may. After every heavy rain they become almost impassable. Stones, loose or fast, are rarely disturbed. The "mending" which they receive frequently makes them worse. An intelligent observer estimates that 90 per cent. of the labor taxes during the past 20 years has been thrown away to the farmers in most of the townships of the State; and it may be certain that so long as

the condition of country roads depends on the ignorant and shiftless care of a gang of hands turned out for a holiday, bent on celebrating their annual "working out the tax" in jollification, unrestricted by intelligent oversight, so long rural populations must be subjected to inconvenience, dangers and losses. Any one who has compared the ease and freedom with which a team travels over a hard, smooth track and the hard work required to drag a load through mud and over stones on badly made and managed roads, or noted the seasons when traffic is suspended, or small loads hauled to market at an expense absorbing their value, cannot fail to recognize the necessity of greater attention to this important subject. The farmer who lives in a neighborhood of good roads is practically much nearer market, mills, schools and churches than he who must travel the same distance over rough, muddy and stony roads. If access to these is of advantage, good roads are admitted to be sanitary measures and tending toward wholesome conditions. Roads were long ago declared to be the tests of civilization. Wagons, harness and horses last longer, owners accomplish the work more rapidly and with greater satisfaction, and thousands of dollars will be annually saved in every country by good roads in place of bad ones.

COUNTY ROADS.

But if the roads which merely join parts of the same district are with advantage properly constructed and maintained, much more must the highways which stretch out their vigorous arms across a county or a State, and draw together distant populations, merit intelligent care. Recent progress in road making is very limited; it is questionable if we have made so little advance in any other department of constructive science; we, as a country, are far behind Europe in this particular. We have relied too largely on railroads for the development of our territory. In sections of the country, the railroad companies have encouraged the construction of public roads, adjacent to their lines, by delivering road material at bare cost, on the principal that these feeders increase the territory and traffic reached by their roads. Certainly communities should be at least as zealous in their own behalf.

No waste can be looked upon as wholesome. Power and time needlessly lost in the transactions of trade make themselves felt in the development of communities. Gillespie, in his work on "Roads and

Railroads," gives some excellent illustrations of loss occasioned by "chance" roads. In Anglesea, England, an old road rose and fell between its two extremities, twenty-four miles apart, a total perpendicular amount of 3,540 feet, while a new road laid out by Telford, between the same points, rose and fell only 2,257 feet; so that 1,283 feet of vertical height is now avoided, which every horse passing over the old road had previously been obliged to ascend and descend with its load. Other equally-pointed illustrations may be found in all parts of the country. In laying out new roads the "ounce of prevention is better than the pound of cure." M. Morin, in his very careful experiments in Paris, established the following proportions of force to load on various surfaces (on a basis of one to two-ton loads). On common earth road, 1 to 11; on earth road, in good condition, 1 to 29; telford road, very dry and smooth, 1 to 54. To appreciate the difference which would be occasioned by travel on these various roads let us assume a case. It is admitted that a horse at steady work all day will exert a force of 120 pounds. Suppose a team drawing loads successively over the above roads; on the telford they can draw $240 \times 54 = 12,960$ pounds; on the very good earth road, $240 \times 29 = 6,760$; on the ordinary earth road, $240 \times 11 = 2,640$; or it takes five times as many teams to cart a given weight on the ordinary dirt road as on the telford. If the cartage on the dirt road requires 25 teams a day, on the telford road 5 would do the work; these at $4 a day would effect a saving of $80 a day or $24,000 a year. It is no easy matter to overlook the waste of bad roads in the face of such figures. It is readily seen that if any construction would save $24,000 a year, $480,000 at 5 per cent. might be invested in it with advantage, since the saving effected in the haulage would be only one of the benefits; convenience, comfort, less wear of horse-flesh and vehicles, speed, freer trade (owing to wider district available), and all the benefits of civilization which come with increased intercourse would be received. [Under the same conditions here given the annual saving on good gravel over the earth road would be $16,800.] To put the matter in another way. If we could, by improving a road, double the freight carried by each team at an expense of $2,000 per mile, we would, on a basis of 15 miles a day for loaded teams at $4, save interest of this cost at 5 per cent., in the passage of 375 loaded teams, annually.

Were it within the scope of this article such striking illustrations of the waste of money incident to bad roads could be multiplied till

even the unreasonable reader should be satisfied. But it is not possible to give this subject further space here; the case is a strong one and easy of complete demonstration.

If rural districts secure advantages by improving highways leading to the populous centers, no less important are the benefits received by the inhabitants of the latter. The increased communication develops trade, food products are more abundantly secured, in better condition and at lower prices, suburban property is developed, and the tendency to overcrowd the centers is lessened.

A strong illustration of the advantages incident to good county roads is secured in the record of successful development in Essex county, in this State. Much could be desired in these roads which is not now obtained, but the results secured should encourage similar work throughout the State. Every year the line of growth is pushed farther from the county seat, and every year Newark's influence and contributing territory widen. It would be well for the latter city if the pavements within her limits compared at all favorably with the radial county roads. It is notable that the development of the county has been confined closely to these roads, except where municipalities along their lines have raised the standard of their own street pavements and secured lateral growth.

Thorough study of the subject (not here possible) will make apparent the immense service rendered by good county roads in developing parts of the State now unproductive. How best to secure uniformity and certainty in this matter is worthy of the most careful thought and action. To procure a healthy state of internal communication and trade nothing else can take the place of well-kept public roads. And it is possible to secure them at a cost easier to be borne than the present insufficient and wasteful system. The picture of the entire State happy and prosperous in possession of good and well-kept roads is an attractive one. To produce it is a matter for thoughtful legislation.

VILLAGE, TOWN AND CITY STREETS.

As we approach the centers of population we find the direct sanitary benefits of properly constructed roads increasing rapidly with the increase of adjacent populations. It is to be remembered that the aggregate area of the street surface of towns and cities varies from one-quarter to one-half of the entire area. The character of this large

exposed surface, with which the entire population comes intimately in contact, cannot fail to affect their health.

The principal requisites of a roadway within towns are properly included in the following points: 1st, cheapness of first construction; 2d, rapidity of construction and facility in repairs when taken up for gas or water-pipes, or sewers; 3d, durability; 4th, firmness of foothold for horses; 5th, smoothness; 6th, noiselessness; 7th, cleanliness; 8th, imperviousness to water. Little consideration is given to most of these points in determining present practice in the State. It would be difficult to discover which essentials were in mind when "cobbles" were selected as surfacing for a very large share of the streets of our cities, in some cases as much as 90 per cent. of the paved surface. It might be possible to overlook this abominable folly, if there were a tendency to supersede it by proper pavement. But it is lamentable that the first cities of the State are every year laying a large number of cobbles on important streets, with hardly a dissenting voice.

It will be profitable to consider *seriatim* the requisites prescribed.

First. Where the tax-payer is consulted, economy is a premise which may safely be assumed. Construction, however, should be cheap, only so far as it is consistent with other requisites.

Second. The construction of a new pavement involves interruption of travel. In some cases this produces serious inconvenience, which increases rapidly with the length of the interruption. It then becomes important to reduce to a minimum the time of construction. This is perhaps an objection—on crowded streets—to concrete foundations, which must be allowed to "set" for at least a week before bearing the heavy travel. But the writer deems this objection of small importance, and considers that the public, if enlightened, would submit to the inconvenience necessary in order to secure the more reliable and durable pavement. This conclusion is based on the fact that in Liverpool, where there is probably more heavy traffic than in any other city in the world, the most important thoroughfares have been entirely paved on Portland cement concrete foundations.

More system should be used in introducing municipal improvements to prevent their conflicting. Frequently a street is paved, and soon after ripped up to lay a water-pipe, only a short interim, and then up it comes to accommodate a gas-pipe, and then still later a sewer trench disfigures the paving. Added to these are the service pipes from the houses frequently put in without any consideration for the pavement,

or restrictions or regulations from the authorities. Such tampering with public property is far too frequent and should be avoided where possible, and carefully regulated whenever necessary. To provide for the occasions when the pavement must be torn up, it should be so constructed that it may be replaced without material detriment. Too much care cannot be exerted to secure this result.

Third. On durability depends the comparative economy of different pavements. If one pavement costs $4 a square yard, and another $2, and the first lasts twice as long as the second, obviously the first is preferable, since it avoids the double breaking up of the street and interference with traffic. More than this, the average character of the first pavement is superior to the second, since it only once reaches the condition requiring renewal, and it is recognized that pavements in the last stages of usefulness are more dangerous to health and more expensive for traffic than at other periods of their existence.

A pavement, like every other structure, where permanence and durability are sought, should have a substantial foundation; under the influence of traffic, the best wearing surface possible will give way unless provided with a sufficient foundation. The surface material must be both tough and hard; actual tests on short pieces of pavement secure the only conclusive testimony in selecting a new material. On these two elements rests very largely the durability of any pavement.

Fourth. The desirability of a firm foothold for horses, always great, increases with the weight of the traffic. Exceedingly valuable statistics have recently been compiled by Capt. F. V. Greene, showing the liability of horses to fall on various kinds of pavements in the chief cities of this country. Over 800,000 horses and 81,000 miles were observed; the distance traveled before an accident occurred was, on asphalt, 583 miles, and granite, 413 miles. A less number of observations showed on wood 272 miles.

In London, the number of accidents from all causes is, owing to local causes, nearly three times as great, but according to observations detailed by Mr. Haywood, the eminent city surveyor, the relative dangers of asphalt and stone remain the same while the falls on wood are far less frequent. Cleanliness of pavements adds materially to their safety. Stones which polish or become slippery under wear should be rejected.

Fifth. The advantages of smoothness on a street surface are not appreciated. To the pleasure driver nothing can compare with the

delightful sensation of rolling along a beautiful avenue in a carriage without a jolt or a jar. This is by no means limited to the mere gratification of a fancy. Jolts mean wear to the vehicle and the pavement; they are noisy and wearing to the rider. The presence or absence of a smooth street pavement near the homes of invalids or delicate persons frequently determines whether they are to enjoy the benefits of a drive in the fresh air or be confined to the house. From a smooth even surface rain finds easy flow to the gutters and outlets, and the detrimental accumulations of water are avoided. The smoother the surface the less the needed "crown," reducing the disagreeable and expensive tendency of the wheels to slide toward the gutter. A smooth surface is easier to keep clean. Smoothness with hardness of surface results in great economy of horse power. Mr. Rudolph Hering has forcibly shown that if 1 horse can just draw a load on a level of iron rails, it will take $1\frac{2}{3}$ on asphalt; $3\frac{1}{3}$ on best Belgium blocks; 5 on ordinary belgrain blocks; 7 on good cobble-stones; 13 on bad cobble-stones; 20 on ordinary earth road, and 40 on a sandy road:

The following very generally approved table is of interest, show- the traction on level roads formed of different materials, asphalt being taken as the standard of excellence:

Sheet asphalt	1.0
Stone blocks, dry and in good order	1.5 to 2.0
Stone blocks, in fair order	2.0 to 2.5
Stone blocks, covered with mud	2.0 to 2.7
Macadam, dry and in good order	2.5 to 3.0
Macadam, in wet state	3.3
Macadam, in fair condition	4.5
Macadam, covered with mud	5.5
Macadam, with stones loose	5.0 to 8.2

Do we appreciate this? Admit the truth of these figures and the conclusion is irresistible. On asphalt a saving of 65 per cent. of the cost of haulage on ordinary belgian blocks—such a saving cannot be looked upon as theoretical; it affects the value of foods, materials and property, and touches the pocket of every citizen. The question needs careful consideration.

Sixth. Noise, as a rule, indicates wear; as a sequence, noise is expensive. The clatter and rattle of wagons over rough pavements tell that nuts are wearing loose, rivets are giving out, loss is occurring. Noisy pavements are not comfortable surroundings, but it is no mere refine-

ment to say that by reducing the din on street pavements the brain and nerves are relieved of incessant rough vibration, and this relief must be beneficial to health. This is a serious matter. Quiet in a large town where stone pavements are used is scarcely possible for a moment.

The testimony of M. Fonssagrives, Professor of Hygiene at Montpelier, which is quoted by Gillmore, is valuable: "I cannot consider such purpetual vibration of the nerves as harmless, even for those who have been born and bred in the midst of the noise. It is a very genuine cause of erethism and to it must be ascribed the prevalence of nervous temperaments and diseases in the large towns. At the periods of a woman's life when she is most subject to nervous maladies, this danger should be most carefully guarded against. And what shall we say of the nerves of children and invalids? If the former are hard to rear in cities which create hysterics at eight years of age, some of the evil must be attributed to the influence exercised by noise on these little beings, in whose organization the cerebral predominance is the most marked feature. As for invalids, quiet is of the first importance, and the noise in the streets is the cruelest stumbling block in the way of recovery." The testimony of other physicians of eminence is available and corroborative. The following statistics are significant. The population of Chicago in 1868 was 5.1 times what it was in 1852. During the same period deaths from nervous disorders increased 20.5 times. Much of this remarkable wear on the nervous system is due to the fast life of the people; nowhere, perhaps, are the national characteristics of haste more fully developed. But there can be no doubt that the roar of street pavements adds materially to the nervous strain, already large from other causes. It has been well said that modern American city life is a battle of the nerves. From nursery to school, from school to college, or to work, the strain of brain and nerves goes on. In the city office, the weary toiler in the midst of long hours of work and few of rest, endures with aching head, the banging and clatter of street pavements, and feels the rasping and filing on the cord of life, wearing it thinner and thinner, till it snaps and frees him from his toil.

In all the great capitals of Europe it seems settled that the roar of noisy pavements will not be tolerated; smooth and quiet surfaces are being laid as fast as money is available. We have even greater need for such action here, in view of the national characteristics which increase our nervous tension.

Seventh. Few communities would appreciate the intimation that they lacked cleanliness, but a very small number have learned the desirability of cleanly streets. In the heart of one of the large cities of the State the writer is acquainted with a street of considerable importance, whose surface is a composition of earth and cinders; it has no regular pavement. From this street not a shovelful of dirt has been carted for years; every two or three years when the rains have washed a large quantity of the street into the gutters, making even the faulty drainage less effective, a gang of men throw this rich compost out into the street to "round up the center," and distribute disease; the process is then repeated. The street is shady and in summer is kept well watered, fostering miasmatic exhalations. Can anything be more repulsive? Yet there would be no merit in this illustration did it not reflect characteristics more or less prevalent in every town. Macadam and Telford pavements in the suburbs are almost never cleaned. Cobble-stone pavements usually get an *annual* scraping, when a crop is reaped which in size commends the conservatism of our city fathers. Granite blocks are usually laid in such a superficial way that joints soon become open and the surface rough; out of these irregularities it is difficult to get the dirt, and no adequate effort is made. Horse manure, the droppings from wagons (loaded with everything under the heavens), garbage, and wearings of the street surface are ground into a fine powder, moistened and saturated by street sprinkling and rain. The mass, ripe for putrefaction, furnishes rich soil for ferments and the development of germs, and then dried by winds it is whisked into the eyes, nostrils, mouths and lungs of passers-by, is blown in at the windows and swept out at the door, and so it goes on, a continual round of annoyance. With the growth of lung, throat and eye affections there is certainly reason to reduce this nuisance, even if there were no considerations of convenience, or repugnance at the personal absorption of the filth. To one familiar with the painstaking street cleaning in European capitals, the neglect here prevalent is astonishing. In Berlin the writer specially noted the cleanliness of the asphalt pavements. Every night the entire surface is thoroughly swept and then washed with a hose and jet, and finally any remaining water or dirt scraped with a rubber hoe toward the gutter and the liquid washed into the sewer. During the day men and children with brooms and pans are constantly collecting droppings and emptying them into ornamented iron cylinders, placed at intervals along the street, from

which they are taken in carts and sold. Similar care is used in other European cities.

The essentials of a street surface to secure cleanliness are: 1st, it forms little dust or mud from wear; 2d, it is easily cleaned. With these qualities secured, systematic and frequent cleansing should follow. Whenever the importance of this subject is more fully realized, considerable modification will be made in designs of pavements at present used in the State. Cleanliness is now practically impossible; but in the face of bad construction, efficient methods of cleaning should be introduced; the importance of proper construction will then speedily appear. The economy of clean streets is shown in one phase by the table given in discussing "smoothness," where the draft appears by experiment to increase rapidly on the same pavement, with the addition of dirt and mud.

Eighth. Imperviousness is a very desirable characteristic in a pavement. It was the theory of Macadam that the natural soil is sufficient to carry the loads passing over it if kept dry; so he aimed to drain the soil and cover it with a water-proof coating of broken stone. In this way he obtained a fair roadway for light traffic, at a small expense. Telford did better, for he secured all that Macadam did, with the advantage of a durable foundation capable of bearing indefinitely heavy traffic, and less liable to form ruts. So far as the writer is aware, granite blocks, wherever used in the State, have been laid with pervious or open joints. The day has long since passed that justified the absurd practice of laying the blocks on a few inches of sand, lightly tamping them, and then sprinkling a little sand over the surface, or filling the joints with it. The first rain-fall washes the sand from the surface or down through the joints and leaves each stone insulated and resting on a yielding foundation until the street filth finds its way into the joints. Attention is also called to the rapid deterioration of pavements laid in this way. One stone sinks bodily one-half inch perhaps; wheels passing over it drop from the other stones with added percussion and drive it still deeper; soon adjacent stones sink a little, water collects in the hollow, and penetrating beneath the blocks, softens the supporting ground; more stones sink and the hollow grows. Six months is usually enough to see all these phases in the life of a new pavement constructed as described, and to find the surface uneven and dirty. Urine and dissolved organic matters percolate freely through the joints and into the subsoil, and give

rise to unpleasant and dangerous exhalations. The filth found in the joints and beneath the blocks of old pavements is frequently black and putrid. The exhalations from this putrescent matter in warm, damp weather, and the dust blown from it in windy weather are most serious sanitary objections, for the conditions are just those for developing germs and bacteria. The area of joints in a block pavement covers nearly one-half of the entire paved area, and to construct these so that they may act as receptacles for the most filthy matter should not be countenanced even were there no questions involved of maintaining the uniformity of the surface and the durability of the pavement. It is believed that the pavement which combines most completely the qualities here enumerated will best meet the requirements of efficiency, economy and health.

CONSTRUCTION.

It is unnecessary to discuss here the preliminary location of roads and streets; this subject comes so entirely within the province of the civil engineer and requires such close examination and careful skill for each locality and condition that it is but proper, in a popular presentation of the subject, to omit matters requiring so much explanation and study.

Nor is it proposed to deal with details of construction. A wide range of material and design is available; the paper does not seek to limit, but to formulate the principles governing their selection.

The first requisite for a good road is drainage. Removal of the subsoil water, by stone or tile drains, if necessary, and proper form of surface to throw off water falling upon it; lateral slopes with this object vary with the material and grade of the surface. As a guide to road gradients the following table is given. It is based on the load a horse will pull on a level as one:

On a grade of 1 in 100 a horse can pull	0.91
On a grade of 1 in 50 a horse can pull	0.81
On a grade of 1 in 44 a horse can pull	0.75
On a grade of 1 in 40 a horse can pull	0.72
On a grade of 1 in 30 a horse can pull	0.64
On a grade of 1 in 26 a horse can pull	0.54
On a grade of 1 in 24 a horse can pull	0.50
On a grade of 1 in 20 a horse can pull	0.40
On a grade of 1 in 10 a horse can pull	0.25

Grades should be kept below 1 in 30 if possible.

It is an axiom of road construction that it is economy to bring good material from a distance rather than use inferior obtained close at hand. Just where this line is drawn is a matter for experiment in each case with the materials available. A case is instanced when after long experience it was found more economical to use material brought from a distance at $1.78 per cubic yard than material at hand at 50 cents. The saving in material and labor for repairs should enter the calculation.

In sandy and gravelly regions the material at hand, if properly selected and combined, furnishes all that is needed for roads subject to light traffic and pleasure driving. In a large part of the State material of this character is abundant, but is wasted through the ignorance or heedlessness of those who, if actively alive to their own interests, would long ago have appropriated and profited by it.

Too little attention is given to the foundation of roads. If a wagon with a tire two inches wide is loaded with one ton on each wheel, and is drawn over the surface of a road, the latter is compressed one-half ton per inch of tire. Unless the road has substantial foundation to distribute this strain, such load will rapidly cut ruts and so disturb the surface that heavy loads will be impossible. It is for this reason that the invention of Macadam, to construct only a thin surfacing of stone on a drained road bed, is worthless in constructing a durable road. The class known as foundation roads have received merited recognition wherever attempts have been made to construct good highways. Prominent in this class is the Telford road, which consists of a bottom course of large broken stone, closely set by hand—best on their broadest edges and lengthwise across the road—all interstices are to be filled with stone chips and firmly wedged. On this foundation the surfacing of broken stones is laid, similar to Macadam. For foundation any stones not too easily crushed or decomposed by water will do, but the surface stones should be the most durable obtainable; basalt or trap, sienite and granite are the best materials for broken stone roads. For building and surfacing material sharp gravel or screenings of broken stone answer best—no dirt should be used. In very many pleasure drives and park roads in this country gravel takes the place of the macadam of the Telford or foundation roads, furnishing a drive well suited to its purpose. In rolling broken stone roads horse and steam rollers are used. The sprinkling cart should be used with the roller. Experiments recently showed that steam rollers could

do the same work done by horse rollers at one-half the time and one-quarter the cost. It then becomes an easy matter of calculation to decide when the magnitude of the work warrants the extra outlay for the steam roller. Evidently the weight of the roller should be proportioned to the traffic which the road must bear. Broken stone roads, if properly maintained, answer well the requirements of light traffic of suburban towns and pleasure drives. But the great cost of maintenance under heavy traffic, their frequent renewal, the large detritus washed into the gutters or sewers, the dust in dry weather, and the mud in wet, restrict their usefulness within towns and cities. Other forms of pavement have therefore been devised. It is proposed to mention a few of the general classes of pavements now in successful use.

Attention has already been called to the necessity for better foundations and impervious joints for stone block pavements. Two or three cities of the State have so far advanced as to put down on their best streets granite block pavements. Thus far they are to be commended. But without wasting further compliments, reference is made to the discussion above of stone blocks laid on sand with open or pervious joints, which is the prevalent practice. It is believed that a stone block pavement should consist of durable oblong blocks, which will not polish or become slippery, $3\frac{1}{2}''$ to $4\frac{1}{2}'' \times 10''$ to $15'' \times 6''$ to $9''$, with the long dimension across the street, and the short one on the line of travel, so laid as to break joints, on a substantial foundation, preferably Portland cement concrete $5''$ to $8''$ thick, and with the joints filled with some impervious material, preferably a bituminous mastic, in which gravel or splinters of stone are imbedded while it is soft. For the latter purpose a grouting of cement mortar is sometimes used, or cement mortar little more than damp is tamped or caulked into the joints. Cement is but feebly elastic, and tends to disintegrate under the continued jars.

The added durability of pavements constructed in this way more than compensates for the extra cost over the flimsy work mentioned; other advantages which are reaped will hardly be omitted after once the trial is made.

PROCESSES.

Burnettizing, kyanizing, creosoting, etc., for the preservation of wood, are so effective that it is believed that if any of them were

honestly applied to wood blocks for paving, and these were laid on a suitable foundation and maintained, an excellent pavement might be secured. It must be admitted, however, that the experience with wood block pavement in this country has been peculiarly discouraging, but in London and Paris it has met with marked favor. Under existing conditions—the questionable opportunity for securing a durable pavement of wood, the strong prejudice against it founded on past failures, and the injurious effect of decaying wood on the health of the people—there seems no reason to urge its general introduction.

Searching examination of the merits of various pavements has resulted in awarding a very conspicuous position to asphalt. An expert commission in 1876 selected sheet asphalt for paving Pennsylvania avenue, Washington, D. C., to be laid with Valde Travers compressed rock, on a concrete foundation. The experiment has been so successful that at the beginning of 1886, 1,000,000 square yards had been laid in the Capital, transforming it into the best paved city in the country. Meanwhile, in Buffalo, New Orleans, St. Louis, Omaha, Philadelphia, Boston and other cities, large quantities have been laid with unvarying success. About the middle of last July, Race street, Cincinnati, was paved with sheet asphalt. A resident of the city recently wrote: "Immediately the traffic of the city was concentrated there; no noise, no dust, no mud; the street is cleansed every night. Property is now selling at 33 per cent. above any figures before attainable."

In Chicago, residents on Dearborn avenue give similar testimony. Although the sheet asphalt has achieved greatest success, block pavements of asphalt are of merit and are less expensive. The special advantages of asphalt pavements are well condensed by Gen. Gillmore. "They produce no dust, and, therefore, no mud; (2) are comparatively noiseless, the clicking of the horses' feet excepted; (3) do not absorb and retain noxious liquids, but facilitate their prompt discharge into the side gutters and sewers; (4) they are impermeable and emit no noxious vapors themselves, or allow their emission from the subsoil; (5) they reduce the force of traction, and, consequently, the expense of wear and tear upon animals and vehicles to a minimum; and (6) although they do not furnish as secure a foothold for animals drawing heavy loads as stone blocks in narrow courses, or as small cobble stones, still they do not become polished and slippery from continued wear." On account of the smoothness of asphalt it is found necessary to confine it to grades of 1 in 50 or less, but this is no

reason to reject it for general use, as such grades are infrequent, and when they occur some rougher pavement offering better foothold may be introduced. Asphalt has been unjustly credited with the faults and failures of many worthless imitations, usually composed in part of some variety of tar. The distinction is a wide one, it is hardly possible to define it here; but the writer would suggest the wisdom of being familiar with these facts before sailing off into a tirade as foolish as it is unjust. Asphalt pavements, as now constructed, are no experiment, and they are abundantly benefiting the cities in which they have been constructed. They are less expensive than good stone pavements. They are much more durable than is generally supposed, and in Boston have been shown to be well adapted to very heavy traffic. The writer believes there is hardly a street in the State over which the traffic is so heavy as to make the use of asphalt undesirable. Pavements of various other materials and combinations are constructed, but there seems hardly need for their discussion here.

MAINTENANCE.

Were there a determined effort to keep roads and streets in good condition, a decided improvement in the character of the original construction would speedily follow. For the maintenance of country roads present efforts are entirely inadequate; an intelligent head to direct repairs is essential, and something more than attention once a year is needed.

For the maintenance of broken stone roads two methods are practiced: (1) Continual patching whenever the road tends to deteriorate. This is considered to be best applicable to roads of moderate traffic. (2) Periodical additions to the entire surface, bringing the road at intervals to the original thickness. It is to be assumed that for either system intelligent direction will be secured. The first system is best adapted to roads of this class now constructed in the State. Statistics, somewhat old, but as strong now as when first collected, are given showing some advantages of proper maintenance. Accurate facts of this kind are now rarely compiled. The post road from Caen to Tours, in France, 150 miles long, was announced in an official report in 1836 to be in danger of becoming impassable, and a demand was made for a special credit of $10,000 and a large amount of material. Its reconstruction was commenced in January, 1837. During '34 the

mail had required 5 horses, and 11 died from overwork. In '38 the number of horses was reduced to 3. In '39 a lighter conveyance was introduced carrying 9 passengers, drawn by 1 horse at from 7 to 8 miles per hour. In 1841 only 2 horses were required and none were lost from overwork. The expense for maintenance in '37 was $5,400; in '41 it was $3,010.

The principles governing economical road traffic are (1) secure substantial construction, giving special attention to the foundation and road-bed; (2) having brought the road to a high degree of hardness and smoothness never allow it to deteriorate. As has already been shown, cleanliness is important in maintaining roads. Pavements within cities should be protected against careless and irresponsible tearing up to put in water, sewer or gas-pipes. The surface should be kept as near uniform as possible. Greater cleanliness should be enforced. The increased difficulty and therefore cost of cleaning rough and pervious jointed payements, if they are cleaned, will itself frequently be enough to pay interest on the cost of a very superior pavement and at the same time secure all the other advantages of such improvement. *Cobble-stone pavements and all pavements with pervious joints can never be properly cleaned.* The remedy is in securing impervious pavements, and in using hose and jet to aid the sweepers.

The subject of the article is so broad that the writer has felt great difficulty in treating it in the limits allowable; it has been the effort to draw attention to important omissions in present practice rather than present new matter. There is a general heedlessness to the waste of power occurring in haulage in city as well as in outlying districts; this is probably due to familiarity with it. Wherever a slight advance is made, instead of stimulating to added effort it soothes with the assurance that it is much better than before. Good roads are the first thing needful to advance the common interests of a growing people. The better they are the closer the communication and more active the trade.

There seems no way to calculate the benefit to the health of a people provided with good and cleanly streets, but that they are of advantage directly to those living near them, and also foster wholesome recreations, as driving among the delicate or well-to-do classes, there can be no doubt. This latter consideration may not seem weighty, but it must be remembered that among the classes mentioned there is a ten-

dency already prevalent to confine delicate women and children to the house, where their frail constitutions are little able to resist sickness which may be developed. The consideration has its mercenary side, for wealthy men seeking homes have been known to credit these matters so weightily as to deprive towns unprovided with streets suitable for pleasure driving of their valued residence as heavy tax-payers. As general conclusions, it is suggested that sufficient authority should be created to secure proper construction of country roads; for ordinary roads gravel surfacing on a drained road-bed, intelligently laid out, and for more important ones broken stones are well adapted. On streets in residence towns, on suburban roads, or on the less important streets of cities, broken stone or some variety of "foundation" roads should be used. Where traffic is excessive, durable granite blocks, laid as recommended above, may be used; for all residence streets, and others not designated in cities, some variety of pavement which fairly meets the requirements given above should be adopted; preference is given for ordinary cases to sheet asphalt laid on a concrete foundation. For *all* cases better maintenance and cleaning should be secured, alike in the interests of health, comfort and economy.

An appeal is made to the public, and particularly to those controlling construction, maintenance and health, to deeply consider this important matter. Good street coverings are not merely luxuries, they are conservators of wealth, comfort, convenience and health.

They are not less important to the toiling thousands, many of whom are injured by constant exposure to the mingled dust full of unstable organic matter.

THE HYGIENE OF OCCUPATIONS.

The effects of all industries on the health of those that pursue them is one of the most important subjects of hygiene. The more fully and accurately the subject is studied, the more apparent it is that in many trades and occupations the real or working life of the operative is greatly shortened by the occupation or the conditions under which it is pursued. Nor is it less apparent to the skilled investigator that many of the causes of this shortened period of labor or of life are preventable. Labor is suffering from this curtailment of healthful working power more than from any other cause. It is time that it should be more urgently dealt with from the standpoint of political economy. While that form of inspection which seeks to limit the employment of children is important, it needs the addition of sanitary care and study of occupations, in the hands of skilled experts, in this department. The facts furnished by Hirt, in Germany, and by Dr. Greenhow, in England, have been mostly confirmed. The recent decennial record of England and Wales, which has been fully studied out from large statistical data and by competent persons, shows the sad havoc that is being made. We quote a few of the facts, as in our country there is less perfection of oversight. We may remember, as aiding in the comparison, that the comparative mortality figure of the clergy is 556, and of farmers 631. Hatters have the mortality figure of 1,064; printers, 1,167; glass manufacturers, 1,190; earthenware and china manufacturers, 1,742; cotton industry, 1,088; woolen and worsted industries, 1,032; dyers and bleachers, 1,012; plumbers, painters and glaziers, 1,202; cutlery, needles, etc., 1,273.

Even such contrasts do not give a full idea of the loss of time and

labor by operatives, since most of these occupations cause long-continued disability.

Hatters suffer most from high temperature and mercurial poisoning. The facts given in our second report are this year supplemented by others.

Glass manufacturers suffer more than some suppose. The record is made in the shortening of the time of effective labor, and in the effect upon children. The dust from kilns, the high temperature and the glass-blowing, cause many lung affections.

Potters are much injured by irritating dust and exposure to vicissitudes of temperature. The physicians of Trenton report much impairment of physical vigor as resulting from the occupation. In textile manufactures, the evil arises from the minute particles of fabric and imperfect ventilation. Artisans in cutlery suffer, as do ma those in other callings, from irritating dust. So common have labor diseases become that the awkward but expressive name of monokoniosis has been given to them. Prof. Peterson, of Bu gives an interesting summary as to such diseases. He says:

"There are certain employments whose victims are confined to in which the air is laden with dust of either an organic or inor nature.

"There are the workers in coal and graphite mines whose lung the inhalation of their dust, become miniature coal mines in the c of time. There are the laborers in iron and steel, such as file-ma grinders, pin-pointers, cutlers, and needle-makers, the air respir whom containing sharp, irregular, angular particles of iron, silver, and emery—substances exceedingly difficult of removal. are the workers in stone, clay and glass, and in jewel-polishing, as cement-makers, potters, glass-grinders, stone-cutters, lime-bur plasterers, brick-makers, diamond-cutters and masons. Then we those whose employments lead them to breathe an air full of ma contributed by the vegetable kingdom, carpenters, chimney-swe moulders, millers, cotton-carders, grain-shovelers, charcoal-burn and workers in flax, hemp and tobacco. Moreover, such occupati as brush-making, wool-cleaning, silk-carding, making feather or ments, hair-picking and button-making, expose the operatives to inspiration of various animal substances, some of exceedingly ir tating nature.

"In breathing the ordinary dusty atmosphere of cities, the quantity of dust inhaled is small, and it is easily removed by natural provisions in the lungs. But besides the dust of the streets in cities, we have an enormous quantity of carbon poured into our urban atmospheres by locomotives, manufactories and dwelling-houses.

"There is for this reason more dust inhaled than can be removed by secretion, gravity, ciliary motion and coughing. This excess of dust remains in the lungs. In looking at the epithelial cells lining the air-passages with a magnifying power of three or four hundred diameters, many of these are found to contain in their protoplasm dust-particles of various sizes and shapes. * * * Large numbers of the particles of dust remain in the tissues, but more enter the lymphatic spaces and vessels which they completely fill, or are carried by their currents to the glands along the bronchi previously described. Here they lodge, these glands becoming the chief storehouses of inhaled dust. This is what becomes of the surplus of dust daily inhaled by every inhabitant of every city. Gradually the lungs become discolored by long lines and patches of black carbonaceous matter. * * *

"Thus far, I have been speaking of the lungs of those who suffer but to a moderate extent from pneumonokoniosis. Now let us turn to the operatives in the various dusty occupations I have mentioned. I will enumerate results in a few of them only. Some kinds of dust being more irritative than others, various degrees of chronic bronchitis, or bronchial catarrh, are brought about. The walls of the air-passages and bronchial tubes thicken to an enormous extent, owing to a chronic pneumonia, in which new connective tissue is formed. Masses of stored-up dust may excite acute inflammations, followed by the formation of abscesses and cavities; in fact, a fatal phthisis is brought about. In the bronchial glands it is no uncommon thing for inflammation of a suppurative nature to take place. These glands may become so large as by pressure on a bronchus to offer serious mechanical interference to respiration. Coal-dust does not seem to irritate as much as other substances, and though in coal-miners the lungs may be so filled with anthracite as to leave little trace to the naked eye of lung structure, yet the number of deaths from phthisis among them is less than one per cent. * * *

"It is among iron, steel, stone and clay operatives that the most disastrous results are obtained. Flint-makers suffer to the enormous extent of eighty per cent. from phthisis, needle-polishers following with seventy per cent. and file-cutters with sixty-two per cent. It attacks only about forty per cent. of stone-cutters, although physicians meet with so many cases that they have given it the name of 'stone-cutters' consumption.' Grindstone-makers, sieve-makers, grinders, lithographers, cigar-makers, brush-makers and glass-cutters, average between forty and fifty per cent. of deaths from phthisis. Gussenbauer has described a disease of the bones and marrow due to the inhalation of mother-of-pearl dust by button-makers. Among cotton-workers we have the form of consumption known to the profession as 'cotton phthisis,' the dust raised by beating being composed chiefly of silicious particles, cotton fibres, and woody matter; they all suffer more or less from the bronchitis, dyspnœa, etc., which are the phenomena of that form of pneumonokoniosis known as byssinosis pul-

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"There are certain employments whose victims are confined to rooms in which the air is laden with dust of either an organic or inorganic nature.

"There are the workers in coal and graphite mines whose lungs, by the inhalation of their dust, become miniature coal mines in the course of time. There are the laborers in iron and steel, such as file-makers, grinders, pin-pointers, cutlers, and needle-makers, the air respired by whom containing sharp, irregular, angular particles of iron, steel, silver, and emery—substances exceedingly difficult of removal. There are the workers in stone, clay and glass, and in jewel-polishing, such as cement-makers, potters, glass-grinders, stone-cutters, lime-burners, plasterers, brick-makers, diamond-cutters and masons. Then we have those whose employments lead them to breathe an air full of matters contributed by the vegetable kingdom, carpenters, chimney-sweeps, moulders, millers, cotton-carders, grain-shovelers, charcoal-burners, and workers in flax, hemp and tobacco. Moreover, such occupations as brush-making, wool-cleaning, silk-carding, making feather ornaments, hair-picking and button-making, expose the operatives to the inspiration of various animal substances, some of exceedingly irritating nature.

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"There are the workers in coal and graphite mines whose lungs, by the inhalation of their dust, become miniature coal mines in the course of time. There are the laborers in iron and steel, such as file-makers, grinders, pin-pointers, cutlers, and needle-makers, the air respired by whom containing sharp, irregular, angular particles of iron, steel, silver, and emery—substances exceedingly difficult of removal. There are the workers in stone, clay and glass, and in jewel-polishing, such as cement-makers, potters, glass-grinders, stone-cutters, lime-burners, plasterers, brick-makers, diamond-cutters and masons. Then we have those whose employments lead them to breathe an air full of matters contributed by the vegetable kingdom, carpenters, chimney-sweeps, moulders, millers, cotton-carders, grain-shovelers, charcoal-burners, and workers in flax, hemp and tobacco. Moreover, such occupations as brush-making, wool-cleaning, silk-carding, making feather ornaments, hair-picking and button-making, expose the operatives to the inspiration of various animal substances, some of exceedingly irritating nature.

"In breathing the ordinary dusty atmosphere of cities, the quantity of dust inhaled is small, and it is easily removed by natural provisions in the lungs. But besides the dust of the streets in cities, we have an enormous quantity of carbon poured into our urban atmospheres by locomotives, manufactories and dwelling-houses.

"There is for this reason more dust inhaled than can be removed by secretion, gravity, ciliary motion and coughing. This excess of dust remains in the lungs. In looking at the epithelial cells lining the air-passages with a magnifying power of three or four hundred diameters, many of these are found to contain in their protoplasm dust-particles of various sizes and shapes. * * * Large numbers of the particles of dust remain in the tissues, but more enter the lymphatic spaces and vessels which they completely fill, or are carried by their currents to the glands along the bronchi previously described. Here they lodge, these glands becoming the chief storehouses of inhaled dust. This is what becomes of the surplus of dust daily inhaled by every inhabitant of every city. Gradually the lungs become discolored by long lines and patches of black carbonaceous matter. * * *

"Thus far, I have been speaking of the lungs of those who suffer but to a moderate extent from pneumonokoniosis. Now let us turn to the operatives in the various dusty occupations I have mentioned. I will enumerate results in a few of them only. Some kinds of dust being more irritative than others, various degrees of chronic bronchitis, or bronchial catarrh, are brought about. The walls of the air-passages and bronchial tubes thicken to an enormous extent, owing to a chronic pneumonia, in which new connective tissue is formed. Masses of stored-up dust may excite acute inflammations, followed by the formation of abscesses and cavities; in fact, a fatal phthisis is brought about. In the bronchial glands it is no uncommon thing for inflammation of a suppurative nature to take place. These glands may become so large as by pressure on a bronchus to offer serious mechanical interference to respiration. Coal-dust does not seem to irritate as much as other substances, and though in coal-miners the lungs may be so filled with anthracite as to leave little trace to the naked eye of lung structure, yet the number of deaths from phthisis among them is less than one per cent. * * *

"It is among iron, steel, stone and clay operatives that the most disastrous results are obtained. Flint-makers suffer to the enormous extent of eighty per cent. from phthisis, needle-polishers following with seventy per cent. and file-cutters with sixty-two per cent. It attacks only about forty per cent. of stone-cutters, although physicians meet with so many cases that they have given it the name of 'stone-cutters' consumption.' Grindstone-makers, sieve-makers, grinders, lithographers, cigar-makers, brush-makers and glass-cutters, average between forty and fifty per cent. of deaths from phthisis. Gussenbauer has described a disease of the bones and marrow due to the inhalation of mother-of-pearl dust by button-makers. Among cotton-workers we have the form of consumption known to the profession as 'cotton phthisis,' the dust raised by beating being composed chiefly of silicious particles, cotton fibres, and woody matter; they all suffer more or less from the bronchitis, dyspnœa, etc., which are the phenomena of that form of pneumonokoniosis known as byssinosis pul-

monum. Moulders suffer from anthracosis pulmonum, which frequently results in phthisis. They use exceedingly fine charcoal in their moulds when casting bronze, copper and iron, which fills the atmosphere about them. Among potters the dust raised causes bronchitis and emphysema, the latter being so common as to give rise to the name, 'potters' asthma.' There is a 'grinders' asthma' known among cutlers, a form of consumption, and extremely fatal.

"Particles of all these substances are found in the lungs with the microscope, though sometimes their recognition is not easy. It is occasionally difficult, for instance, to distinguish between the fine molecules of coal, iron, stone and hæmatoidin, the red pigment of the blood. The lungs may be full of a dark pigment not due to inhalation at all. This is the slaty deposit of the Germans. It is found only in chronic pneumonitis, however, where there have been extravasations of blood, followed by decomposition of red blood globules in the tissues. * * *

"Among hemp, silk, flax, wool, hair, brush-making and cotton operatives, there is seldom any difficulty in recognizing their trades from a microscopical examination of parts of their lungs. Hirt made an autopsy on a maker of feather ornaments. The air-passages were found almost occluded by feathers and dust. Sometimes among charcoal-burners one finds pieces of charcoal sufficiently large to see a pore or two under the glass. Iron and steel particles may be distinguished by proper chemical tests, such as nitric acid and ferrocyanide of potash. The tests for silicic acid will often reveal the presence of stone or glass. * * *

"Thus far, we have been considering solely the inhalation of *irritating* particles, some having more tendency to excite disturbance than others; and we find that they cause almost always chronic bronchial catarrh, may cause emphysema, and often lead to pneumonia and phthisis. There are occupations which force artisans to inhale not only *irritating* but *poisonous* substances. There is among tobacconists a form of dust-inhalation known as 'tabacosis pulmonum,' where we not only have some of the inflammatory effects described above, but also a variety of nervous disorders produced by the nicotine of the tobacco-dust. Some of the most deleterious of the trades are those where men are compelled to work in atmospheres impregnated with particles of arsenic, mercury, lead and copper. Those who suffer most in these occupations are makers of artificial flowers, wall-papers, lead-miners and workers, hatters, painters, enamelers, type-founders, compositors and coppersmiths. It is said that the hair and bones of coppersmiths become green from the absorption of acetate of copper. Type-founders, compositors and others who work in lead, inhale sufficient to irritate the lungs and at the same time to produce often the serious colic and paralysis of lead poisoning. Hatters are exposed to arsenic and mercury poisoning, while those who make green wall-paper and artificial leaves are apt to suffer from arsenic."

DISEASES OF WORKERS IN IRON AND GLASS.

At Wheeling, West Virginia, ten large iron and nail concerns employ about 5,700 men and boys, and twelve glass-works employ about 2,650 persons. Dr. John L. Dickey, a physician of that city, gives the following valuable results of his observations and experience:

WORKERS IN IRON.

"The 'boilers' and their 'helpers,' some of them stripped to the waist, are exposed to the intense heat of the puddling furnaces as they stir the molten metal. Perspiring from every pore, they will gulp down large draughts of ice-water or step outside and stand for a few minutes in the open air or in a stiff river breeze. As they are quitting work, preparatory to going home, they are accustomed to bathe their arms and bodies in the convenient tanks of constantly-running water. Such sudden coolings are, of course, liable to cause congestions, which may be followed by some of their manifold consequences.

"The 'rollers' and 'hookers,' from the nature of their work, are more liable to strains, of muscles as well as joints. Muscular rheumatism, myalgia (cramps in the muscles) and thecitis (inflammation of the sheaths of tendons) are not infrequent among them. Over-heating and sudden cooling, of course, lend their share in causing these troubles.

"The nail-feeders, sitting for hours at a time on their hard, back-less stools, become more or less stoop-shouldered, and many of them are naturally troubled with hemorrhoids. * * *

"More distinctive and more formidable, however, than all the other diseases and injuries to which these workers in iron are subjected is the so-called 'nailers' consumption,' which, in technical language, might be termed *phthisis fabrum clavorum*. Accepting the division of the causation of phthisis into the two classes of general and local, nailers' consumption comes under the latter. It is the mechanical or irritative form of this dread disease, and resembles anthracosis, or miners' consumption; millstone-makers' consumption; cotton consumption, to which the operatives in cotton-mills are liable; stone-masons' consumption, and knife-grinders' consumption. The last named is probably identical with nailers' consumption, as it is due to the irritation set up by particles of steel and stone-dust. Ten or twelve hours a day the nailer and nail-feeder are breathing in an atmosphere laden with minute particles of iron and steel. The nailer has charge of three or four machines, and much of his time is spent in the grinding-room sharpening the knives of the nail

machines on large, rapidly-revolving sandstones, the dust from which is an additional source of irritation to his air passages and lungs. The feeder is not exposed to this dust of the grindstones, but this danger is partially balanced by his sitting constantly on his stool in a cramped position, inspiring the metallic dust. The great bulk of the danger, however, falls on the nailer, and, no matter how broad-shouldered and full-chested he may be, nor how robust in health, he must succumb sooner or later. Besides grinding the knives, he finds it necessary to use, three or four times a day, the 'patent scraper' for leveling the face of the stone, which becomes worn in grooves and grows smooth and glazed on the surface with the particles of steel. The scraper is attached to the frame, and a white, choking cloud of coarse stone-dust fills the air, which, in the words of a workman, is 'very hard on the lungs.' In order to obviate the danger from grinding, to some extent, Eastern nail-mills formerly used, as a rule, wet stones, but this method is too slow and is not much in vogue at present. Two of the mills here—the LaBelle and the Benwood—have introduced large and powerful fans for removing the dust. The stones are encircled half-way round by troughs, which lead into a larger conduit, through which is passing a strong draught from the fan. By this means, at least, half of the refuse is removed. It is claimed that the good results can already be seen in the improved looks of the nailers of these two mills, and that they lose less time from work on account of sickness.

"Various forms of inspirators for excluding these irritating particles have been devised, but no one of them has ever come into general use, either because they were found inefficient or on account of a false pride among these men, that prevents many of them from using such things. A handkerchief is sometimes worn over the nose and mouth, a sponge is tied in front of the face, or more complicated apparatus in the shape of inhalers is occasionally used. One of the simplest and most ingenious devices of this kind, which is used to some extent, was originated by a very intelligent nailer, a few years ago, and consists of a large artificial moustache, which affords considerable protection both to the nose and mouth. The most perfect inspirator is a small frame of wire gauze fitted to the nose. Inside of the frame is a bunch of cotton, which catches all the finer particles that escape the outer screen. The cotton can be frequently changed, which is an advantage over inspirators that are more costly and more complicated, for they soon become foul and worthless. * * *

"Dr. Edwards, who has been the City Health Officer during the past eight years, informs me that the death record during this period shows that forty-three nailers and four feeders have died in that time; forty died of so-called nailers' consumption, the remaining seven from other causes. These, of course, were only of the four factories within the city limits. This record is not entirely reliable from the fact that

very often the physician filling out the death certificate neglects to give the occupation; but, on the other hand, the occupation of nailer and nail feeder is more generally given than any others. The average age of these forty men was found to be less than thirty-nine years. By a rough estimate, made from the above-mentioned record, the number of nailers that die of consumption is about eighty out of every one hundred. From Lawson on Phthisis, we learn that the number of people not exposed to special causes, who die of consumption, is about fourteen out of one hundred; the highest average he gives is among those exposed to the inhalation of mineral particles, seventeen out of one hundred. Niemeyer gives the general average of fourteen to twenty in every one hundred.

"Dr. J. E. Reeves tells me that he carefully examined one hundred and thirty-six nailers, a few years ago, and found only one out of the whole number whom he regarded as sound, and whom he would have recommended to a life insurance company as a good risk. In all of the others he heard bronchial respiration and discovered other signs of consolidation in different degrees.

"The Ohio Valley Protective Union and at least one of the old line life insurance companies, will not insure nailers, no matter what would be the result of a thorough examination, for the occupation is regarded as too hazardous.

"There can be no doubt that an important factor in the high mortality of nailers' consumption is the dissipation to which many of these men are addicted. They make big wages and spend money freely. * * * If a nailer, who is free from an inherited tendency to phthisis, and has no natural or acquired predisposition to the disease, wears a good inspirator while working, and takes other precautions to guard against the dangers of his trade, at the same time living temperately and giving intelligent attention to his hygienic surroundings, he contributes a material share toward lengthening the short average of a nailer's life."

WORKERS IN GLASS

Are liable to certain diseases and injuries, peculiar to their work and surroundings. In many factories most of the workmen are not exposed very long at a stretch, their time being divided into 'turns' of five hours each, an industrious workman making ten or eleven turns in a week.

"All are exposed, more or less, to a high degree of heat, but this has been much modifed in late years by improvements in ventilation. A strong draught of air is driven by fans through large pipes which run to different parts of the factory and around the furnaces. These pipes have vent holes at short intervals which allow the cool air to blow on the workmen near the furnaces, or from which rubber hose

conducts it to the presses for cooling the moulds. The 'finishers' are generally exposed to the heat of the room on the one hand, or the cool air from a door or window near which they sit, on the other. The 'snappers' are exposed to the intense heat of the 'glory holes' at which they stand to melt the ware.

"The workmen who are more subject to burns, which are seldom of a serious character, are the 'gatherers,' who roll up lumps of the molten glass out of the pots and drop it into the moulds to be pressed. The 'carrying in boys,' running to and fro, sometimes get serious burns by coming in contact with the hot glass. Probably as many of these accidents happen from 'sky-larking' as from attending strictly to work.

"The materials used in the manufacture of glass are sand, soda and lime, to which smaller quantities of arsenic and manganese are added. The 'mixers' generally protect their nose and mouth with handkerchiefs. They are subject to fits of coughing and sneezing, and to more or less nasal catarrh, from the irritation of this mineral dust. The sensitive mucous membrane of the eyes also suffers from the same cause, and conjunctivitis is not uncommon with the mixers. Chronic lead poisoning, with its train of well-known symptoms, often occurs among mixers, where flint glass is made, in which lead is used.

"The 'packers' use fine oat straw and prairie grass in packing the glass in boxes, barrels and crates for shipment. They are exposed to the dust and chaff from this material, which is very irritating and sets up nasal catarrh.

"The 'washers,' women and girls employed in washing the ware, have their hands constantly in water, and often get their feet wet. Many of them, consequently, suffer from rheumatism.

"The 'mould-makers' work in cast-iron. They cut the metal with chisels, and often get chips in their eyes. A young mould-maker came to me recently with a speck of metal imbedded in the cornea. Although he had not been working at the trade very long I discovered several scars on the cornea from former injuries. I induced him to guard against such danger in the future by wearing a pair of wire-gauze eye protectors with fronts of plane glass.

"Emphysema and hypertrophy of the heart are frequently found among glass blowers, from the over distension of the lungs caused by long and hard blowing. But not so much of this is done now as formerly, and only in the manufacture of window glass and hollow ware.

"Glass making proper seems to be a healthful occupation, and glass makers who live temperately and take good care of themselves enjoy ordinary good health and fill out the full average of years."

The remedy for such of these evils as can be corrected is to be sought by (*a*) informing both employers and workman as to the real risks and remedies, therefore, (*b*) by having competent inspectors and

(c) by passing such laws as to buildings as shall secure the best sanitary conditions. Science and experience have shown what wonderful improvements can be made. Heating and ventilation can be regulated without draught. Dust can be to a great extent removed. Places for washing and eating can be provided. Foul particles can be passed through fire, and so in many ways the welfare of the worker be promoted. Take as an instance, cases in which it is desirable to get rid of dust or any particles unfit for breathing. The object then is to prevent the diffusion of such materials through the atmosphere of the room or building.

"In these cases it becomes necessary to construct tubes with openings near the source of pollution, and connected at the other, or exit end with a fan, which, when working, produces a powerful exhaust, and carries away the polluting matter as fast as it is produced. This arrangement may be, and is, applied with perfect success to remove dust, heat, steam and fumes of various kinds. The tubes may be carried overhead, underneath, or level with the sources of pollution, and the impurities carried away may be dealt with in a chamber, so as to retain them and allow the air to escape pure. A good type of this arrangement has been largely carried out for the prevention of what is called 'woolsorters' disease.' The men who sort the wool work at continuous tables, which usually are fixed along the sides of large rooms, close to the walls, and at which each sorter works opposite a window, on account of the light. In sorting the wool, the sorter takes a portion from a heap placed on the table near him, and shakes it to loosen and open it out, so that he may judge of the quality, color, &c.; and it is at this point that the greatest danger of infection occurs, as the shaking sets free the dust, short fibres and other light matters, amongst which may be the bacillus, or germ of infection. To prevent or, at any rate, lessen the risk of infection, there is made opposite each sorter an opening in the table, to which is fixed a short downcast tube, which is connected to a larger horizontal tube beneath the table, at the extremity of which is working a fan that produces a powerful exhaust current in the system of tubes, and carries away the dust produced by the sorters shaking the wool, which they do over the open ends of the small tubes.

"In opening the bales of wool, also, a similar arrangement is used, but on a much larger scale, as the quantity to be dealt with is very much greater. In both cases there are wire gratings above the tables to keep the wool out of the tubes and allow the solid, but not floating, matters to fall on the table for collection. This dust is most successfully dealt with by being blown into a settling chamber, in which a series of steam-jets meet and damp it, so that it is deposited, and can be collected and burnt periodically.

"I may mention, amongst other applications of this system, the removal of dust from silk-dressing machinery, in which the main air-ducts are carried overhead, with small vertical dependent tubes, terminating in hoods, which cover the area of dust-production, confining it and facilitating its removal.

"The fine dust produced by dry grinding processes, in which metal is ground against rapidly revolving discs of emery or stone, is also removed by a similar arrangement, in which the main tubes are about level with the grindstones, and have openings opposite each stone, in such positions as to catch the dust as it is driven off and carry it away at once.

"It will occur to any one acquainted with work in factories that this system of extraction along tubes may be applied with great advantage in many cases."

The great difficulty at present is that both workman and their employers are careless, or changes are made according to the notions or suggestions of those who have no accurate knowledge as to the best methods.

The inquiry into offensive trades, and the remedies as presented by Dr. Ballard in the report of the Local Government Board of Great Britain, is an illustration of what can be done in a single direction. If only the certain knowledge now had as to the mode of securing the most healthful conditions for work could be applied, it would greatly add to the success of most industries, and add days and years of working capacity to thousands of workmen. Where men or women or children are assembled for any industrial occupation, it is their right and the right of the State that they should not be subjected to any avoidable causes of ill-health. We have directed the attention of our citizens into this subject in former reports. We this year add a few inquiries which have been conducted by competent observers. We hope, from time to time, to examine into most of the prominent in-door industries of this State, and to report upon the same.

DISEASES OF HATTERS.

It is my purpose in presenting this paper for your consideration, to have you go with me in imagination to the various departments of a hat-shop and make some observations concerning, (1) the various processes of manufacture and their attendant dangers; (2) the hygienic

condition of the rooms in which the operators work; (3) the physical condition of the employes. Having done this, and considered statistics, so far as I have been able to furnish them, we will be in a position to draw some satisfactory conclusions regarding the diseases to which the hatters are especially prone.

Let us begin with the "Forming Mill" and study the various processes there carried on. The first room we enter is the "mixing and blowing room." In this department the fur, which consists of long and short fibres taken from different kinds of fur-bearing animals, is run through "picking" or "mixing" machines and thus made of uniform quality. The next process is to run this mixed fur through a blowing machine, which consists of five to nine consecutive pickers, which separate the pelts, "dags," and hair from the fur, the dust escaping through the wire screen placed above the revolving pickers. It should be stated here, that the dust just referred to escapes into the room and pervades the air which the men inhale. This blown fur is next sent to a room below, called the "forming" room, where it is weighed by girls (sometimes by boys) in the prescribed quantities for a dozen hats, and then placed in boxes. It is next put upon a Gill forming machine where the fur is placed by a girl called a "feeder" upon a revolving apron, and run through rotating pickers which disintegrate the fibres, and throw them into the chamber in which the revolving perforated copper cone is placed, and upon which the fur fibres are formed into the hat-body. When the batch of fur has all been drawn upon the cone by the exhaust fan beneath it, the "coners" cover it with cloths, thus holding the compressed "bat" upon the cone; over these a tin cover is now placed, then the cone, dry bat, cloths and covers are all removed and placed upon a rack suspended over a tub of hot water, and into which they are all immersed. They are then withdrawn and placed upon the bench, the tin cover and wet cloth removed, and the cone upon which the wet bat remains is turned upside down, and the bat slipped off and placed upon the bench, meanwhile another cone has been placed within the chamber, and when the "bat" is formed, the operation of covering, etc., is repeated. The men who work at this branch of the trade, the "coners" and "wetters," stand on wet floors, many of them wearing no shoes or stockings, and those who do, have their feet wet most of the time. They also have their arms bared to the elbows. The wet bats are placed in cloths, and the water squeezed out. They are then taken to the hardener's

bench where they are spread out in batches of a dozen, and are rolled back and forth to harden them or partially felt them. They are then folded up, put into bales and sent to whomsoever they may be consigned.

We must now consider, briefly, the hygienic condition of this department. The mixing-room is, as a rule, large, well-lighted, comfortably heated and sometimes furnished with ventilators for the escape of foul air. There is, however, no apparatus provided for the removal of the fine particles of fur which actually make the room look cloudy. The proprietor, when questioned about the effect this fur might have upon the lungs, said: "It is not expectorated by the men, and does not irritate the throat or lungs." His statement was verified by the testimony of the men at work. In another mill, however, I found that the operatives (doing similar work) were somewhat affected by this fine fur. They complained of dryness of the nostrils and throat, sometimes positive soreness. Several years ago, before ventilators were put into Mr. Gill's mill, he discovered that the blowing-room hands were affected with shakes. As soon as this state of affairs was known to exist, he promptly had ample ventilators furnished, and soon succeeded in restoring those already diseased to health, and prevented others being similarly poisoned. These ventilators, it should be understood, do not offer a means of escape for the fur fibres which pervade the air of the apartment, they are intended simply for the removal of the impure air. There should, however, be some suitable apparatus devised by means of which most of the fur dust could be removed from the room, for it seems apparent that air literally filled with dust of *any* kind, is not the *best* air for entrance into the lungs, throat or nostrils. I am told that in England the men who work in any room where there is dust in the air, wear small pieces of cloth over the nose to prevent the dust gaining entrance. These (mixing) rooms, because of being on the top floor and provided with many windows, may be, and as a matter of fact, usually are, freely supplied with fresh air during the warmer months of the year, and even during the winter months the air finds its way through the crevices of the closed windows as well as through those which are occasionally opened, so that so far as mere quantity is concerned, there need be no fault found, but as to quality, much may be said in criticism. These rooms are dry, so that there is no risk incurred from dampness. We next consider the *physical* condition of the men in this department. Let us hear their own testimony, which is a follows:

No. 1. Aged 20; has been engaged in the business 2 months; feels perfectly well. In this, as in other instances, the time of active duty was so short that no conclusion could be arrived at as regards the effect of the employment upon the health of the individual.

No. 2. Aged 37; has been 5 years in the business; does not complain of any form of illness; uses beer and tobacco.

No. 3. Aged 60; has been 14 years in the business; has never had "hatters' shakes," but has catarrh, cough and more or less headache; uses beer but no tobacco.

No. 4. Aged 58; 11 years in the business; had the "shakes" several years ago; also has catarrh, although it has been worse than it now is; has slight rheumatism.

No. 5. Aged 16; 9 months in the business; well.

No. 6. Aged 28; 6 years, 7 months in the business; never had the "shakes;" has never had catarrh; uses beer.

No. 7. Aged 21; 1 year, 4 months in the business; no "shakes;" has slight catarrh and dyspepsia, and says his general health is not good.

No. 8. Aged 20; 5 years in business; never had "shakes;" feels perfectly well; uses beer and tobacco.

No. 9. Aged 25; 1 year in the business; well; uses beer and tobacco.

No. 10. Aged 21; 4 years in business; never had the "shakes;" is quite well; uses beer and tobacco.

No. 11. Aged 22; 2 years in the business; has not had the "shakes" but has the catarrh (pharyngeal).

No. 12. Aged 50; 7 years in the business; never had the "shakes;" has occasional rheumatism; uses beer and tobacco.

No. 13. Aged 35; 4 years in the business; never had the "shakes;" has slight cough and pain in his legs; uses beer and tobacco.

No. 14. Aged 28; 8 years in business; never had the "shakes;" has had rheumatism.

No. 15. Aged 15; 4 months in the business; says the fur "stops up" his nose and makes it dry; otherwise he is not affected.

No. 16. Aged 16; 1 month in the business; the fur enters his nostrils and causes him some distress.

No. 17. Aged 15; 5 weeks in the business; the fur which enters his nose causes him to pick his nose a good deal; this leads to considerable irritation of the mucous membrane.

No. 18. Aged 15; 2 weeks in the business; complains of sore nose.
No. 19. Aged 13; 1 year in the business; has sore throat and nose.

It will be observed that these boys complain of sore nose much more frequently than the men. Perhaps they are not as careful to avoid inhaling the dust as the older operatives, and it may be that the short stature of the boys has somewhat to do with it, their mouth and nostrils coming much closer to the fur, as they feed it to the machines, than is the case with the men. In another shop, I was told by a man who had worked at this business eleven years that he regarded the handling of the dry fur in the mixing-room as far more dangerous than the work done by the "coners" or "wetters," because in the dry state the fur fibres are more readily inhaled, and once introduced into the nose, throat or lungs they are very apt to cause trouble, either irritation of the mucous membrane or mercurial poisoning, the latter being possible because of the nitrate of mercury which the fibres contain in appreciable quantity. My informant has had mercurial sore mouth, very bad catarrh, rheumatism, loss of appetite and impairment of memory. I also learned that the men who worked in this particular mill suffered more from catarrhal affections than was the case in some of the other mills visited, as will be seen by the record, viz.:

No. 20. Aged 37; 20 years in the business; is now absent from the mill to be treated for salivation; has bronchitis.
No. 21. Aged 15; 1 year in the business; has nasal catarrh.
No. 22. Aged 27; 4 months in the business; has nasal catarrh.
No. 23. Aged 18; 2 months in the business; has slight catarrh.
No. 24. Aged 22; 1 year in the business; has pharyngeal catarrh.
No. 25. Aged 32; 11 years in the business; sore mouth, catarrh, rheumatism and impairment of memory.
No. 26. Aged 21; 7 years in the business; has the "shakes."
No. 27. Aged 21; 1 year in the business; has nasal catarrh.
No. 28. Aged 35; 1 year, 5 months in the business; well.
No. 29. Aged 20; 2 months in the business; well.
No. 30. Aged 18; 6 months in the business; has the catarrh.
No. 31. Aged 18; 1 year, 6 months in the business; says the dust irritates his nose.
No. 32. Aged 18; 4 years in the business; has catarrh; uses tobacco.

No. 33. Aged 17; 8 months in the business; has slight catarrh; uses tobacco.

No. 34. Aged 19; 1 year in the business; has sore nose occasionally.

No. 35. Aged 18; 1 month in the business.

We learn from these statements that of 35 employes, 16 have had catarrh; 4 have had irritation of the nasal mucous membrane; 3 have had rheumatism; 2 have had the "shakes;" 2 have been salivated; 1 has had bronchitis; 1 has had cough; 1 has had dyspepsia; 5 state that their health has not been affected by their occupation.

I have been told that many more operatives would be affected with "shakes," "salivation" and respiratory difficulties if the time of service were longer than it usually is. In one of the mixing-rooms I visited there was a "self-feeder," an improvement upon the mixing machine in general use. It will, if it should substitute its predecessor, cancel the great danger to health in this department, namely, that constant exposure of the respiratory apparatus to the fine fur as it now pervades the air. It will do this because there need be no boy or man constantly near it, in order to supply it with fur. One of the men in this room told me that if they had, instead of the present style of "mixing machines," these self-feeders, two boys only would be required where seven or eight are now employed.

The next room to be hygienically considered, is the "forming-room." Now, I venture to assert, that if you were to draw your conclusions as to the probable effect of the various kinds of exposure upon the health of the men who work in this room, from what you *see* as you first enter the apartment, you would say with emphasis, men can not long endure such treatment of themselves without having their health impaired. I think you would say this, because as you look along the line of "coners," you observe the fact that many of the men (in some shops) stand upon wet floors without any protection for their feet, their trousers being rolled up to the knee. The next thing you note is the long line of hot-water tanks, into which the men plunge (by means of a rack) the cones after they are removed from the "cone chambers." In performing this operation the water is splashed to some extent upon the operators, who with bared arms are constantly transferring the cones from the chamber to the bath, and *vice versa*, in this manner keeping their trousers wet so long as the work continues. You also observe that the temperature of the room is suffi-

ciently high to induce free perspiration when the men are at work. As you look to the left of these men you see the hardeners, who first place the hat bodies upon their bare arms, thus exposing themselves to mercurial poisoning, and then roll them back and forth to secure a sufficient degree of hardening. Walk to the other side of the room and you see what you regard as new dangers. The "feeders" and "weighers," particularly the latter, are surrounded with fine fur, which it seems must enter the lungs. On this side of the room, however, the floor is quite dry. When you look for the ventilators, you see nothing but the windows, and you involuntarily say, here are the conditions favorable to the development of diseases of the respiratory organs and rheumatism. And when we question the men we do not alter our opinion. We interrogate them in order, with the following result, viz. (beginning with the "coners"):

No. 1. Aged 49; 18 years in the business; has had the "shakes;" has pharyngeal catarrh; has also had rheumatism; uses beer and tobacco.

No. 2. Aged 50; 8 years in the business; has not had the "shakes," but is troubled somewhat with the catarrh (nasal).

No. 3. Aged 45; 21 years in the business; never had the "shakes" and feels perfectly well; uses beer and tobacco.

No. 4. Aged 43; 7 years in the business; has catarrh, but says it began to trouble him before he became a "coner," and his work makes it no worse; has had rheumatism; uses beer and tobacco.

No. 5. Aged 37; 6 years in the business; never had the "shakes;" is quite well; uses beer and tobacco.

No. 6. Aged 19; 8 months in the business; well; uses beer and tobacco.

No. 7. Aged 24; 5 years in the business; never had the "shakes;" health good; uses beer and tobacco.

No. 8. Aged 35; 3 years in the business; never had the "shakes;" does not feel as well as when he is in the open air; uses beer and tobacco.

No. 9. Aged 39; 3 months in the business; well; uses tobacco.

No. 10. Aged 46; 15 years in the business; has the "shakes;" uses beer and tobacco.

No. 11. Aged 30; 20 years in the business; never had the "shakes;" has rheumatism occasionally; uses beer and tobacco.

No. 12. Aged 22; 4 years in the business; never had the "shakes;" has slight catarrh, and has had rheumatism; uses beer and tobacco.

No. 13. Aged 31; 2 years in the business; never had the "shakes;" health good; uses beer and tobacco.

No. 14. Aged 34; 9 months in the business; well; uses beer and tobacco.

No. 15. Aged 20; 5 years in the business; never had the "shakes;" feels perfectly well; uses beer and tobacco.

No. 16. Aged 43; 18 years in the business; has never had the "shakes" or any other malady; uses beer and tobacco.

No. 17. Aged 45; 2 years in the business; never had the "shakes;" has rheumatism; uses beer and tobacco.

No. 18. Aged 39; 1 year, 6 months in the business; no "shakes;" has neuralgia in face, due, he thinks, to wet feet; uses beer and tobacco.

No. 19. Aged 43; 2 years in the business; no "shakes;" feels quite well; uses beer and tobacco.

No. 20. Aged 25; 2 years in the business; never had the "shakes;" has slight catarrh, also rheumatism; uses beer and tobacco.

No. 21. Aged 45; 5 years in the business; never had the "shakes;" health good; uses beer and tobacco.

As the "wetters" work with the "coners," it will be proper to classify them together, it will therefore be understood that the remainder of the list will refer only to the former class of workmen.

No. 22. Aged 37; 8 weeks in the business; is perfectly well; uses beer and tobacco.

No. 23. Aged 35; 2 years in the business; never had the "shakes;" feels quite well; uses beer and tobacco.

No. 24. Aged 18; 2 weeks in the business; well; uses beer and tobacco.

No. 25. Aged 28; 8 weeks in the business; perfectly well; uses beer and tobacco.

No. 26. Aged 32; 2 years in the business; never had the "shakes;" uses beer and tobacco.

No. 27. Aged 26; 15 years in the business; has "shakes," catarrh and dyspepsia; uses beer and tobacco.

No. 28. Aged 53; 7 years in the business; never had the "shakes;" has rheumatism; uses beer and tobacco.

No. 29. Aged 41; 14 years in the business; well; uses beer and tobacco.

No. 30. Aged 42; 16 years in the business; never had the "shakes;" has rheumatism occasionally; uses tobacco.

No. 31. Aged 30; 15 years in the business; well; uses beer and tobacco.

No. 32. Aged 28; 8 years in the business; has the "shakes" and nasal catarrh; uses beer and tobacco.

No. 33. Aged 37; 15 years in the business; never had the "shakes;" has nasal catarrh; uses beer and tobacco.

No. 34. Aged 27; 3 years in the business; never had the "shakes;" has catarrh and dyspepsia; uses beer and tobacco.

No. 35. Aged 42; 25 years in the business; never had the "shakes;" has dilated veins in forearm, also rheumatism, which he attributes to standing on a damp floor; uses beer and tobacco.

No. 36. Aged 50; 20 years in the business; never had the "shakes," but has the catarrh and rheumatism; uses beer and tobacco.

No. 37. Aged 54; 30 years in the business; never had the "shakes;" feels well; smokes, but uses no beer.

No. 38. Aged 24; 6 years in the business; has not had the "shakes," but has had the rheumatism; uses beer and tobacco.

No. 39. Aged 29; 12 years in the business; has not had the "shakes," but has the asthma; uses beer and tobacco.

No. 40. Aged 36; 17 years in the business; never had the "shakes," but has had mercurial sore mouth.

No. 41. Aged 28; 8 years in the business; well.

No. 42. Aged 25; 2 years in the business; never had the "shakes," but has bronchitis and rheumatism.

No. 43. Aged 30; 5 years in the business; never had the "shakes;" uses beer and tobacco.

No. 44. Aged 42; 9 months in the business; well; uses beer and tobacco.

No. 45. Aged 40; 3 years in the business; never had the "shakes;" uses beer and tobacco.

No. 46. Aged 20; 3 years in the business; never had the "shakes;" uses beer and tobacco.

No. 47. Aged 35; 16 years in the business; uses beer and tobacco.

No. 48. Aged 33; 12 years in the business; never had the "shakes;" has the catarrh and rheumatism.

No. 49. Aged 30; 1 year in the business; has the "shakes" slightly; uses beer and tobacco.

No. 50. Aged 19; 6 years in the business; well; never had the "shakes;" uses beer and tobacco.

No. 51. Aged 38; 12 years in the business; has the "shakes," catarrh and rheumatism; uses beer and tobacco.

In review we discover that of 51 cases, 11 have catarrh; 8 have rheumatism at present time, 1 has had it; 5 have the "shakes," 1 has had them; 1 has asthma; 1 has had mercurial sore mouth; 1 has had bronchitis; 46 use stimulants and tobacco; 45 have escaped having the shakes.

We might, perhaps, expect to find more disease than is here shown to exist, for certainly the various kinds of exposure would justify such a belief; but might not the cases of rheumatism and catarrh be reduced in number if proper attention were paid to the protection of the feet and body during working hours? Some of the men told me that notwithstanding the water was hot, which is spilled upon the floor from the tanks, they often experience pain of a rheumatic character, after they have stood several days or weeks upon the floor which is dampened by it. The "hardeners" work at benches placed quite near the "coners" but they are not exposed to so much dampness. They are most liable to mercurial poisoning, because of repeatedly placing the hat bodies, which contain nitrate of mercury, upon their bare arms. Their testimony is as follows:

No. 1. Aged 22; 16 months in the business; never had the "shakes;" has catarrh; uses tobacco.

No. 2. Aged 33; 14 years in the business; never had the "shakes;" has catarrh and occasional rheumatism.

No. 3. Aged 49; 7 years in the business; never had the "shakes;" has the rheumatism.

No. 4. Aged 36; 14 years in business; has not had the "shakes;" uses beer and tobacco.

No. 5. Aged 26; 6 years in the business; never had the "shakes;" has pharyngeal catarrh; complains of dyspepsia.

No. 6. Aged 37; 14 years in the business; never had the "shakes;" has catarrh, both nasal and pharyngeal; has occasionally rheumatism; uses beer and tobacco.

No. 7. Aged 34; 14 years in the business; never had the "shakes," but has the nasal catarrh; has dyspepsia; uses beer and tobacco.

No. 8. Aged 38; 13 years in the business; has never had the "shakes," but has the catarrh; uses beer and tobacco.

No. 9. Aged 39; 14 years in the business; never had the "shakes;" has dyspepsia.

No. 10. Aged 34; 16 years in the business; never had the "shakes," but has the catarrh (nasal); has dyspepsia; uses tobacco.

No. 11. Aged 31; 7 years in the business; never had the "shakes;" health good; uses beer and tobacco.

No. 12. Aged 21; 2 years in the business; has not had the "shakes;" says the fur makes his nose dry; uses tobacco.

No. 13. Aged 66; 27 years in the business; has had the "shakes;" complains of rheumatism; uses beer and tobacco.

No. 14. Aged 30; 14 years in the business; has the "shakes," also catarrh, and occasional rheumatism; uses beer and tobacco.

No. 16. Aged 22; 7 years in the business; has not had the "shakes," but has the catarrh; uses tobacco.

No. 17. Aged 37; 10 years in the business; never had the "shakes;" has the catarrh; uses beer and tobacco.

No. 18. Aged 21; 9 years in the business; has not had the "shakes;" feels quite well.

No. 19. Aged 37; 13 years in the business; has not had the "shakes;" feels well.

No. 20. Aged 21; 2 years in the business; never had the "shakes;" says fur makes nose very dry; uses tobacco.

No. 21. Aged 66; 27 years in the business; has had the "shakes;" uses beer and tobacco.

No. 22. Aged 30; 14 years in the business; has slight "shakes" and catarrh, also occasional rheumatism; uses beer and tobacco.

No. 23. Aged 22; 7 years in the business; never had the "shakes;" has slight catarrh; uses tobacco.

No. 24. Aged 37; 10 years in the business; never had the "shakes;" has catarrh; uses beer and tobacco.

No. 25. Aged 21; 9 years in the business; well.

No. 26. Aged 37; 13 years in the business; well.

No. 27. Aged 41; 26 years in the business; has the "shakes" and catarrh; has been salivated.

No. 28. Aged 24; 5 years in the business; well; uses beer and tobacco.

No. 29. Aged 42; 18 years in the business; has the "shakes" and mercurial sore mouth; uses tobacco.

No. 30. Aged 54; 7 years in the business; has the "shakes" and has had sore mouth; has catarrh; uses beer and tobacco.

No. 31. Aged 37; 18 years in the business; has had the "shakes;" uses beer and tobacco.

Of this number 15 have the catarrh; 5 have the rheumatism; 5 have the shakes; 3 have had the shakes; 2 have had the mercurial sore mouth; 4 have the dyspepsia; 2 complain of dry nostrials; 14 use stimulants and tobacco; 7 use only tobacco; 10 use neither tobacco or stimulants.

Some of the men have very slight muscular tremors, which they do not regard as "shakes," and they also show a wasting of the muscles of the forearm, a point to which Dr. Dennis, of Newark, drew attention a few years ago (1878), in his report to the Board of Health. The only other operatives in this department are the "feeders" and "weighers." Twenty-seven "feeders" were questioned in regard to their health, and all but one claimed to be well. The one exception complained of catarrh. They stand upon elevated platforms, which are dry, and the fur, because of being placed in boxes just beside the revolving aprons, is easily placed thereon without much disturbance of its fibres, hence the air they inhale is not as dusty as it is in the mixing-room. Fourteen "weighers" were questioned, five of whom had catarrh. This is not surprising, as in putting the fur upon the scales it is a good deal disturbed, much of the "dust" being thrown into the air about the individual, and introduced into the nose and throat.

Perhaps it will be wise to refer to the four additional hands employed in the forming mills, namely, the "wringer-out boy," the "bailer," the man who attends to the "devil machine," and the "shaker." The "wringer-out boy" said he never felt well, had constant headache and very poor appetite. The men who worked at the "devil machine" did not complain of any disease. The only reason I could assign was, that they had been only a short time at the business; for how a man can stand several hours every day in such a dense cloud of dust and not have serious disease of the respiratory organs, is a mystery. The "bailer" and "shaker" did not complain of ill-health.

The hat-bodies, after they leave the forming mill, go to the "sizing-room," where they are taken by men called "sizers" or "makers," whose business it is to dip them into hot water, acidulated with sulphuric acid, and then roll them back and forth upon an inclined plane, in order to make the felt contract till it shall be reduced to the proper size. They are next run through a sizing machine, which gives them still greater compactness. In this room the vapor of the hot water is so dense that one can scarcely see the floor or the passage-way between the kettles. The floor, as a rule, is wet—actually has puddles of water at many places—so that as you walk from one group of men to another, you get your feet wet in a few moments. This evil might be remedied by having a "grating" placed over the floor, at least around the kettles where the men stand while at work. The hot-water vapor could all be removed from the room by means of exhaust pipes with funnel-shaped openings, placed over the kettles, and this precaution ought to be insisted upon, for such an apparatus can be easily made and put into position, and the expense would not be great. This hot-water vapor of course deposits itself upon every object in the room (men included) and upon every part of the room; it then drops upon the men at work, giving them a shower-bath from the time they enter till they leave the apartment. In winter this is a serious matter, for with wet clothes, and exposure to sudden changes of temperature, they are very apt to develop either rheumatism or other serious affections. Some of the men wear no shoes or stockings, and those who do, unless they be rubber, have their feet constantly wet. It is true, however, that many of the men wear rubber shoes or boots, also rubber aprons, thus protecting themselves, so far as their feet and lower limbs are concerned. I have also been told that the men (most of them) change their clothing after they finish work in the sizing-room, but they "change" in a room not thoroughly heated, so that the exposure there is attended with some risk. In order to determine what diseases are most common among these men, consult the following table:

DISEASES OF HATTERS.

Number.	Age.	Time in the business.	Catarrh.	Cough.	Rheumatism.	Shakes. Past.	Shakes. Present.	Dyspepsia.	Mercurial sore mouth.	Colds.	Stimulants.	Tobacco.
1	40	22 years	1								1	1
2	38	23 years	1	1							1	1
3	69	40 years	1		1						1	1
4	24	8 years	1								1	1
5	28	9 years	1								1	1
6	55	36 years			1		1				1	1
7	18	2 years									1	1
8	24	7 years									1	1
9	29	15 years			1			1			1	1
10	40	13 years	1								1	1
11	36	25 years									1	1
12	38	25 years									1	1
13	44	25 years	1		1		1				1	1
14	57	30 years			1						1	1
15	38	13 years		1							1	1
16	58	30 years			1						1	1
17	39	24 years								1	1	1
18	21	7 years	1	1			1				1	1
19	32	4 years			1						1	1
20	30	15 years									1	1
21	24	6 years									1	1
22	36	24 years	1								1	1
23	40	24 years	1		1						1	1
24	26	8 years									1	1
25	16	6 months		1								1
26	24	9 years									1	1
27	20	6 years									1	1
28	20	5 years										
29	28	1 year	1	1	1						1	1
30	38	13 years	1	1	1	1						1
31	45	38 years		1	1	1					1	1
32	33	15 years	1	1							1	1
33	40	25 years			1						1	1
34	21	6 years	1								1	1
35	37	23 years	1	1		1					1	1
36	26	2 years	1								1	1
37	32	12 years	1	1		1						
38	42	30 years									1	1
39	35	1 year									1	1
40	31	19 months									1	1
41	28	5 years									1	1
42	32	18 months									1	1
43	34	16 years			1						1	1
44	26	9 years	1	1							1	
45	38	22 years	1	1	1							1
46	23	6 years	1	1							1	1
47	32	17 years		1	1						1	1
48	35	12 years	1									1
49	42	27 years									1	1
50	37	23 years	1	1							1	1
51	37	23 years	1	1		1					1	1
52	37	15 years									1	1
53	26	28 months	1								1	1
54	32	13 years	1			1						
55	42	30 years									1	1
56	35	1 year									1	1
57	31	19 months									1	1
58	28	5 years									1	1
59	32	18 months									1	1
60	33	2 years									1	1
61	63	42 years			1						1	1
62	28	5 years									1	1
63	24	15 months									1	1
64	32	14 years		1	1						1	1
65	22	13 months									1	1
66	22	7 months									1	1
67	55	8 years									1	1
68	51	35 years									1	1
69	17	2 months									1	
70	30	15 years						1				1
71	20	2 years									1	1

DISEASES OF HATTERS—*Continued.*

Number.	Age.	Time in the business.	Catarrh.	Cough.	Rheumatism	Shakes. Past.	Shakes. Present.	Dyspepsia.	Mercurial sore mouth.	Colds.	Stimulants.	Tobacco.
72	27	17 months	....	....	....	....	....	....	....	....	1	1
73	29	20 months	....	....	....	....	....	....	....	....	1	1
74	51	16 years.........	....	....	....	....	....	....	....	....	1	1
75	38	20 months	....	....	....	....	....	....	....	....	1	1
76	49	3 years.........	....	....	....	....	....	....	....	....	1	1
77	27	11 months	....	....	....	....	....	....	....	....	1	1
78	24	11 months	....	....	....	....	....	....	....	....	1	1
79	39	23 years.........	....	....	....	....	....	....	....	....	1	1
80	22	8 years.........	1	....	1	....	....	....	....	....	1	1
81	41	27 years.........	....	....	1	....	....	....	....	....	1	1
82	37	25 years.........	....	....	....	....	....	....	....	....	1	1
83	58	40 years.........	1	1	....	....	....	....	....	....	1	1
84	20	5 years	1	....	....	....	....	....	....	....	....	1
85	26	3½ years.........	....	....	....	....	....	....	....	....	....	....
86	26	8 years.........	....	....	....	....	....	....	....	....	....	....
87	30	3 years.........	1	....	....	....	....	....	....	....	1	1
88	25	4 years.........	....	....	....	....	....	....	....	....	1	1
89	35	3 years.........	....	....	....	....	....	....	....	....	1	1
90	30	3 years.........	....	....	....	....	....	....	....	....	1	1
91	30	2 years.........	....	....	....	....	....	....	....	....	1	1
92	22	8 years.........	1	1	....	....	....	....	....	....	1	1
93	61	....	....	....	1	....	....	....	....	....	1	1
94	25	4 years	....	....	....	....	....	....	....	....	1	1
95	35	3 years.........	....	....	....	....	....	....	....	....	1	1
96	30	3 years.........	....	....	....	....	....	....	....	....	1	1
97	30	2 years.........	....	....	....	....	....	....	....	....	1	1
98	22	8 years.........	1	1	....	....	....	....	....	....	1	1
99	61	12 years.........	....	....	1	....	....	....	....	....	1	1
100	22	8 years.........	1	....	....	....	....	....	....	....	1	1
101	59	29 years.........	....	....	....	....	....	....	....	....	1	1
102	46	38 years.........	....	....	....	1	....	....	....	....	1	1
103	29	4 years.........	....	....	....	....	....	....	....	....	1	1
104	19	2 years.........	1	....	1	1	....	....	....	....	....	....
105	21	2 months	....	....	....	....	1	....	....	....	1	1
106	23	8 years.........	....	....	....	....	....	....	....	....	1	1
107	39	21 years.........	1	....	1	....	....	....	....	....	1	1
108	16	1 year.........	1	....	....	....	....	....	....	....	1	1
109	23	7 years.........	....	1	1	....	....	....	....	....	1	1
110	42	29 years	1	1	1	....	....	....	....	....	1	1
111	31	14 years.........	....	....	1	....	....	....	....	....	1	1
112	22	6 years.........	....	....	....	....	....	....	....	....	1	1
113	27	6 years.........	1	....	1	....	....	....	....	....	1	1
114	20	3 years	....	....	....	....	....	....	....	....	1	1
115	24	1 year.........	....	....	....	....	....	....	....	....	1	1
116	25	18 years.........	....	....	....	1	....	....	....	....	1	1
117	24	9 years.........	1	....	1	....	1	....	....	....	1	1
118	18	4 years	....	1	1	....	....	....	....	....	1	1
119	22	6 years.........	1	1	....	....	....	....	....	....	1	1
120	21	6 years.........	....	....	....	....	....	....	....	....	1	1
121	28	11 years.........	1	....	1	....	....	....	....	....	1	....
122	20	4 years.........	....	....	....	....	1	....	....	....	1	1
123	20	4 years.........	....	....	....	....	1	....	....	....	1	1
124	24	10 years	....	....	....	....	....	....	....	....	1	1
125	21	2 weeks.........	....	....	....	....	....	....	....	....	1	1
126	22	2 weeks.........	....	....	....	....	....	....	....	....	1	1
127	24	2 months	....	....	....	....	....	....	....	....	1	1
128	24	5 weeks.........	....	....	....	....	....	....	....	....	1	1
129	16	1½ years.........	....	....	....	....	....	....	....	....	1	1
130	62	35 years.........	....	....	....	....	1	....	....	....	1	1
131	35	4½ years.........	....	....	....	....	....	....	....	....	1	1
132	17	1 year.........	....	....	....	....	....	....	....	....	1	1
133	22	9 months	....	....	....	....	....	....	....	....	1	1
134	22	5 years.........	....	....	....	....	....	....	....	....	1	1
135	21	7 years.........	....	....	....	....	....	....	....	....	1	1
136	23	9 years.........	....	....	1	....	....	....	....	....	1	1
137	27	2 years.........	....	....	....	....	....	....	....	....	1	1
138	28	3 months	....	....	....	....	....	....	....	....	1	1
139	38	3 months	....	....	....	....	....	....	....	....	1	1
140	22	4 months	....	....	....	....	....	....	....	....	1	1
141	17	3 months	....	....	....	....	....	....	....	....	1	1
142	22	2 years.........	1	1	....	....	....	....	....	....	1	1

DISEASES OF HATTERS—*Continued.*

Number.	Age.	Time in the business.	Catarrh.	Cough.	Rheumatism.	Shakes.		Dyspepsia.	Mercurial sore mouth.	Colds.	Stimulants.	Tobacco.
						Past.	Present.					
143	20	7 months									1	1
144	18	4 months									1	1
145	22	4 months									1	1
146	29	5 months									1	1
147	27	12 years	1								1	1
148	24	16 years	1								1	1
149	39	26 years									1	1
150	50	36 years									1	1
151	52	40 years	1	1							1	
153	30	12 years	1							1	1	1
154	24	10 years	1	1			1				1	1
155	32	15 years			1		1				1	1
156	40	20 years	1	1		1					1	1
157	33	15 years									1	1
158	41	13 years	1		1		1				1	1
159	76	60 years		1							1	1
160	55	45 years									1	1
161	33	16 years		1							1	1
162	19	1 year									1	1
163	19	1 year									1	1
164	22	8 years										
165	32	18 years	1				1				1	1
166	35	25 years	1				1				1	
167	49	3 years	1								1	1
168	33	17 years										1
169	25	3 years									1	1
170	47	34 years	1	1							1	1
171	41	20 years									1	1
172	26	11 years									1	1
173	28	12 years		1	1						1	1
174	32	15 years	1								1	1
175	37	24 years			1	1					1	1
176	32	18 years	1								1	1
177	43	30 years								1	1	1
178	40	30 years									1	1
179	32	17 years				1					1	
180	46	30 years	1								1	1
181	19	2 years	1								1	1
182	46	25 years									1	1
183	36	6 months	1								1	1
184	39	5 weeks									1	1
185	22	7 years										
186	42	22 years	1			1					1	1
187	39	15 years	1					1			1	1
188	51	34 years				1					1	1
189	58	28 years	1			1					1	1
190	38	13 years									1	1
191	19	19 months									1	
192	26	12 years	1		1							
193	32	18 years	1	1			1				1	1
194	23	7 years	1			1						
195	21	5 years	1			1		1			1	1
196	62	50 years										1
197	48	31 years						1			1	
198	25	8 years	1				1	1			1	1
199	29	9 years	1	1				1			1	1
200	19	2 years			1						1	1
201	40	24 years	1								1	1
202	43	22 years									1	1
203	27	10 years									1	1
204	32	15 years								1	1	1
205	40	20 years								1	1	1
206	22	6 years								1	1	1
207	35	17 years			1					1	1	1
208	40	24 years			1							1
209	61	43 years	1									1
210	35	18 years	1	1			1				1	1
211	45	19 years										1
212	28	16 years									1	1
213	19	3 years										
214	50	23 years								1		

DISEASES OF HATTERS—*Continued.*

Number.	Age.	Time in the business.	Catarrh.	Cough.	Rheumatism.	Shakes. Past.	Shakes. Present.	Dyspepsia.	Mercurial sore mouth.	Colds.	Stimulants.	Tobacco.
215	37	10 years	1	...	...	...	...	...	...	1	1	1
216	48	16 years	...	...	...	...	...	...	...	...	1	...
217	43	15 years	...	...	...	...	...	...	...	...	1	1
218	16	...	...	...	...	...	...	...	...	...	...	...
219	20	7 years	1	...	...	...	...	...	...	1	...	1
220	23	6 years	1	...	...	...	...	...	...	1	1	1
221	58	43 years	1	1	1	...	...	...	...	...	1	...
222	40	23 years	1	...	...	...	...	...	...	1	1	1
223	40	26 years	...	...	...	...	...	...	...	...	1	1
224	40	30 years	...	...	...	...	1	...	...	...	1	1
225	32	5 years	...	...	1	...	...	...	...	...	1	1
226	26	13 years	...	...	...	...	...	...	...	...	...	1
227	31	16 years	...	...	...	...	...	...	...	...	...	...
228	26	9 years	...	1	...	...	...	...	...	...	1	1
229	20	3½ years	...	...	...	...	...	...	...	...	1	1
230	22	7 years	...	...	...	...	...	...	...	...	1	1
231	27	10 years	...	...	...	...	1	...	...	...	1	1
232	49	34 years	1	...	1	...	...	...	...	...	1	1
233	27	10 years	...	...	...	...	...	...	...	...	1	1
234	29	14 years	...	1	...	...	...	...	...	...	1	1
235	22	9 years	...	1	...	...	...	...	...	...	1	1
236	41	21 years	...	...	...	...	...	...	...	...	1	1
237	40	20 years	1	...	...	...	...	...	...	...	...	...
238	22	8 years	...	1	...	...	...	...	...	...	1	1
239	62	47 years	...	1	1	...	...	...	...	...	1	1
240	27	12 years	1	...	1	...	...	...	...	...	...	1

This table shows that of 240 "sizers" or "makers," 76 have catarrh; 44 have rheumatism; 41 have cough; 17 have had the "shakes;" 13 now have the "shakes;" 12 constantly catch cold because of sudden change of temperature; 7 complain of dyspepsia; 200 use stimulants and tobacco.

This is a very bad record for this class of men, and should lead to the adoption of such improvements as will render the sizing-room less dangerous to the health of those who work therein.

The hats pass from the "sizers" to men who stiffen the brims. They are then put upon a pulling-out machine, and then into a tank containing a hot solution of dye-stuff. The men who stiffen the hats are not liable to disease of the respiratory organs, but the "dyers," because of being in the hot vapor which rises from the tanks in which they dye the hats, are apt to be the subjects of some form of disease, generally rheumatism or catarrhal affections of the nose, throat or lungs. They do not often complain of mercurial poisoning. I saw six "colorers" or "dyers," one of whom had catarrh and rheumatism, another rheumatism, another cough and dyspepsia, another cough, the remaining two feeling perfectly well.

The hats next go to the "blockers," who put them upon blocking machines in order to give them proper shape. Here again the men

are exposed to the hot vapor, which they are compelled to inhale, for in order to moisten the hats they dip them into small hot-water tanks which are placed just beside them, and in doing this they bend directly over the tank, inhaling large quantities of the vapor. There is also some danger of mercurial poisoning from handling the wet hats.

Eighteen "blockers" were questioned, and of this number 4 have catarrh; 3 have rheumatism; 3 have the "shakes;" 1 has had the "shakes;" 1 has a cough; 1 has frequent "colds;" 11 use stimulants and tobacco.

From the "blockers," hands they go to the "drying-room," where they are exposed to a temperature of about 170° Fahrenheit. Boys are generally employed to attend to this work, and they do not appear to be impaired in health. They do not look "rosy," but they certainly are, as a class, free from any disease. This may be due to the fact that they spend much of their time outside the drying-room, and do not remain long in this department, but soon seek promotion in order to secure higher wages.

From the drying-room the hats go to the "pouncers," who put the hat-bodies upon revolving blocks and cleanse them, by means of emery, of the rough fur which bristles all over the hat when it first comes from the "drying-room."

In this room there is considerable dust, which finds its way into the nostrils, throats and lungs of the operatives. It should be said that a suction tube is generally placed near each block, in order to provide for the escape of as much of the dust as possible, but notwithstanding this precaution, some of the dust escapes into the room, and is inhaled by the men.

Twenty-seven "pouncers" were questioned, and of this number 12 have catarrh; 4 have cough; 3 have the "shakes;" 2 have had the "shakes;" 1 has a poisoned face (mercurial); 14 used stimulants and tobacco.

The hats are now ready for the "finishing-room." It is in this room more than in any other, perhaps, that the health of the operatives is most seriously impaired. In the first place, these rooms are, as a rule, very poorly ventilated. This lack of ventilation leads to the accumulation of considerable fine dust, and prevents the escape of air which contains the mercurialized vapor which rises from the hats while they are being pressed with the hot irons used for that purpose. When the "finishers" take the hats, they place them upon stationary or movable

blocks, and sand-paper and iron them off smoothly. In doing this, they bend over the blocks, bringing the face very close to the iron or the sand-paper, as the case may be. In this manner they place themselves in the best possible position to inhale either the volatilized mercury or the fine fur fibres. I have learned that there is a vast difference between a *high* finishing-room and a *low* one, as regards the health of the men who work in them. The "shakes" are much more frequent in the *low* than in the *high* finishing-rooms. This is due to the poorer ventilation of the rooms on the ground floor. The dust in many of these rooms is imperceptible as it exists in the air (at least in some of the rooms), but if you will go to the window, or the bench, you will find a deposit of dust sufficiently thick to make it possible to trace your name in it. In certain finishing-rooms even the air is made cloudy by the dust which is detached from the hats with the sand-paper.

It is this dust which enters the nose, throat and lungs of the men, and causes primarily, only a slight irritation of the mucous membrane, but secondarily, in many instances, a consumptive process. The danger arising from exposure to the volatilized mercury is also apparently very great, for as the men use the irons, they bend very close to the blocks in order to exert as much pressure as possible upon the hats. As the hats are moistened before being ironed, they are, of course, in just the condition to part with a portion of the mercury which they contain, for the moment the hot iron touches the felt, the mercury, or a portion of it, passes off in vapor, and is very apt to be inhaled by the ironer. But I have not discovered that mercurial poisoning is common at the present day, on the other hand, it is uncommon, so far as my observation instructs me. It seems to be the fine fur dust which does most permanent harm. Some of the men told me they could expectorate black dust *one* or *two* weeks after stopping work. It may be true that the small percentage of nitrate of mercury which these fibres contain acts injuriously upon the lungs, causing, or helping to cause ultimately, a phthisical process. My own belief is, that the damage to the respiratory organs is the result of the mechanical irritation produced by the fur fibres. As a matter of fact, the testimony of 222 finishers will show what diseases they are especially prone to, viz.:

Of those recently visited, 64 have catarrh; 42 have cough; 17 have the "shakes;" 16 have had the "shakes;" 15 have rheumatism; 9

have had mercurial sore mouth; 7 have the sore mouth at present time; 7 have bronchitis; 2 had sore mouth when working in *low* shops; 4 have chest pains; 4 have phthisis; 4 have had catarrh; 1 has dyspepsia; 1 has insomnia; 1 has asthma; 127 use stimulants and tobacco.

It is plainly shown by this list that the diseases of the organs of respiration are far more common than is generally supposed to be the case, and more common than any other disease. It is likewise the most fatal disease the hatters suffer from, most dangerous because it is so comparatively insidious. In England, these operatives wear cloths over their nostrils to prevent the dust entering their lungs. Certainly some simple respirator could be worn, and one danger averted. I have had hatters tell me that when in the open air for several consecutive weeks or months, the throat, lung or nasal irritation would frequently disappear, but as soon as they began work in the finishing-room the old irritation would return.

The hats now pass to the "trimmers" (usually girls), who attach the band, braid and lining to the hat. These girls, many of them, appear pale, but very few of their number complain of actual disease. Much might be done to improve the ventilation of the rooms in which these girls work. In some of them *all* the windows were closed and the temperature so high as to make one uncomfortable, the girls volunteering the statement that they often longed for plenty of fresh air, admitted in such a manner as not to produce a draught. I made inquiry of 113 "trimmers" concerning their health with the following result:

Twenty-three had catarrh; 3 had cough; 1 complained of poor health; 1 complained of insomnia; 1 complained of weak lungs.

The "flangers" now take the hats, place them in the mould and put on them bags of hot sand. One would think, perhaps, that this operation is unattended by danger, but such is not quite true, although the danger exists in a minor degree. The men told me that, occasionally, "shakes" occur in this department. Of 6 flangers questioned, 1 had the "shakes," and 2 were affected with the catarrh.

The "packers" were asked if they were ever affected in any manner by handling the hats. They said that occasionally a man would get the "shakes." We have thus far from statistics given in this paper:

1. That the most common diseases of the "mixers" and "blowers" are *catarrh* and *rheumatism*.

2. That the most common diseases of the "coners" and "wetters" are *catarrh, rheumatism* and "*shakes.*"

3. That the most common diseases of the "hardeners" are *catarrh, rheumatism* and "*shakes.*"

4. That the most common diseases of the "sizers" or "makers" are *catarrh, rheumatism, pulmonary affections* and "*shakes.*"

5. That the most common diseases of the "blockers" are *catarrh, rheumatism* and the "*shakes.*"

6. That the most common diseases of the "pouncers" are *catarrh, pulmonary affections* and "*shakes.*"

7. That the most common diseases of the "finishers" are *catarrh, pulmonary affections,* "*shakes,*" *rheumatism* and *mercurial sore mouth.*

That the most common disease of the "trimmers" is *catarrh.*

We have also learned that the most common of all the diseases of the hatters, while they are at work at their trade, is *catarrhal inflammation* of some portion of the respiratory apparatus. This I regard as a very *significant* fact, especially when it is coupled with the *fact* that the most frequent cause of death among hatters is *phthisis pulmonalis.* Before closing this paper, let me ask you to consider the statistics which I have collected, showing the various causes of death of hatters, working in all the departments of the trade.

Total number of deaths of hatters in Newark and Orange (as indicated by the death certificates) since 1873, 500.

Died of pulmonary phthisis	265, or 53 per cent.
Died of pneumonia	37
Died of chronic bronchitis	9
Died of pulmonary œdema	1
Died of pulmonary hemorrhage	4
Died of pulmonary congestion	1
Died of asthma	2
Died of pneumo-thorax	1

Making a total of 331 cases of all forms of lung lesions, or 66.2 per cent.

The other causes of death in their order of frequency are as follows:

Nephritis	24
Heart disease	24
Injuries	18
Apoplexy	15

Diseases of stomach and intestines	12
Typhoid fever	9
Cancer	5
Gangrene	5
Alcoholism	5
Peritonitis	3

The remaining diseases occur very infrequently; they are such maladies as meningitis, cystitis, enlarged prostate, chronic myelitis, acute melancholia, etc.

Through the kindness of Mr. Thos. F. Foster, I have been able to secure from W. H. Judson, of Bethel, Conn., the following statistics, which show the most frequent causes of death among the hatters in that town.

Total number of deaths reported, 89.

Died of phthisis	33, or 37.7 per cent.
Died of pneumonia	7
Died of heart disease	7
Died of paralysis	5
Died of apoplexy	3
Died of typhoid fever	2

Here again there is a large excess of phthisis over all other forms of disease.

The statistics kindly sent from Danbury, Conn., by Mr. Edmund Tweedy, as follows:

Total number of deaths reported, 76.

Died of pulmonary phthisis	38, or 50 per cent.
Died of pneumonia	3
Died of meningitis	3
Died of apoplexy	3
Died of pulmonary hemorrhage	2
Died of typhoid fever	6
Died of heart disease	3

The remaining diseases are such as abscess of ear, cancer, dropsy, syphilis, etc., etc.

Here we also observe a preponderance of phthisical cases.

Mr. John B. Stetson sends me the record of 26 deaths, all of which have occurred among his own employes during the last four or five years.

Total number of deaths, 26.

Died of consumption	10, or 34.2 per cent.
Died of typhoid pneumonia	5
Died of alcoholism	1
Died of bronchitis	1
Died of typhoid fever	1
Died of heart disease	1
Died of abscess	1
Died of general debility	1
Died of meningitis	1
Accidental death	1
Complication of diseases	2

Total number of deaths reported by secretaries of various hatters' societies in other parts of the country, 31.

Died of pulmonary phthisis.......................29, or 93.5 per cent.

We have then a sum total of 722 deaths; of that number there have died of phthisis, 375, or 51.8 per cent. Of all forms of pulmonary lesions there were 459, or 63.5 per cent.

It is doubtful if any other trade will show such an excess of deaths due to pulmonary phthisis, and should we not, with these appalling facts in our possession, endeavor to prevent the development of this terrible disease—consumption—in the hatters, and put forth special effort to stay its progress in those cases where it has already begun its destructive work. The average life of hatters does not exceed forty years.

NOTE.—Consult N. J. State Board of Health reports also, as follows:

Article of Laban Dennis, M.D., 2d report, 1878.

Trades and Occupations, 3d report, 1879, pages 13 and 126.

Operatives' Consumption, 5th report, 1881, pages 248–250; 6th report, 1882, pages 18 and 24; 7th report, 1883, pages 35, 129, 161, 170, 270 and 271; 8th report, 1884, pages 15–17.

AN INQUIRY INTO THE CAUSES OF DISEASE AMONG WORKERS IN SILK, FLAX AND JUTE.

Preliminary to what is to be said on the subject under discussion, it would be well to remark that these notes are not intended to be exhaustive, but the purpose is merely to glance at the main points

and to leave for the future a more elaborate investigation of the diseases common among workers in *textiles*.

The difficulties that present themselves when one attempts to study trade diseases in this State or country are many, for the vital statistics at our disposal are meagre and imperfect, and very often contain no information of value to the student of this class of diseases. For example, the certificate of death which states that a certain person was a weaver and died of phthisis does not aid us very much. If the record had stated what kind of textile the person worked in, whether wool, silk, cotton or flax, valuable assistance would be given. More important still would be the record if it showed how long the person had worked at that particular trade, how rapid had been the progress of the disease, and what form of phthisis was the cause of death, whether acquired or hereditary. A record thus made up would put us in possession of facts of value and would enable us in a short time to tell what the trade diseases really are.

No more valuable service could be rendered to the State than the careful compiling of accurate statistics concerning the causes of disease among operatives, and the records now being kept in this State will form a good foundation for future sanitarians to build upon.

In considering the diseases incident to particular trades, it is always necessary to exclude those factors common to all trades in that class; thus, in studying the diseases pertaining to factory operatives we must set aside all those causes universal in that class, such as bad ventilation, injuries by machinery and the like, and bring into review only those factors that operate in the special branch of a trade that we are examining. We might, for instance, say that the diseases common to silk weavers, cotton and flax spinners, machinists, and all those working in-doors were induced by bad ventilation or imperfect heating, but this would not explain all, for each trade mentioned has its own train of troubles not common to others, hence we must eliminate the troubles incident to in-door occupations and study the diseases induced by the special trade under discussion.

We must, also, exclude those diseases caused or induced by bad sanitary surroundings at the home of the operative, for such ailments are frequent in all unsanitary localities.

The scope of our study is thus narrowed down to the diseases caused solely by the particular trade, or branch of trade, at which the person works. We shall, therefore, confine our attention to the dis-

eases induced by the processes used in the manufacture of silk, flax and jute, ignoring completely all troubles due to factory life and its surroundings.

SILK.

The processes used in the manufacture of silk may be briefly summarized as follows, disregarding all technical terms:

The raw or crude silk is first boiled in soapy water to remove the glutinous material that coats the fibre. The cleansed or soft silk is reeled or spun and then dyed. Then is woven into ribbons or other fabrics. With the exception of the dyeing, all the processes followed are cleanly, and at no stage of the spinning, reeling or weaving, is the operative subjected to any disagreeable or unhealthy dust or vapor.

The process of dyeing, being common to all textile trades, needs only a brief allusion here, for the diseases or inconveniences caused by the occupation of dyeing are not distinctly a part of the silk business. Suffice it to say that bronchial, pulmonary and rheumatic affections are induced by the hot, moist atmosphere of the dye-house. The dyers are often surrounded with an atmosphere similar to that in a Russian bath. Besides this, the floors of the place are of stone or of rough boards, and often covered with water. The majority of dyers now avoid the troubles, incident to wet feet, by using wooden shoes or shoes with thick wooden soles, similar to the *sabot* so often seen in France and Germany. Much of the inconvenience due to the condition of the air, could be avoided by working blowers to force out the air surcharged with steam or moisture, and to replace it with dry, pure air. Dyers being compelled to keep their hands in the vats containing solutions of dye-stuffs, suffer more or less with dermatitis, limited to the hands and arms; this inflamation varies very much in degree.

Taken as a whole, the trade of silk operatives may be considered a healthful one, and devoid of the dangers common to many of the textile trades.

The work is especially fitted to the capabilities of women and girls, it being generally light and cleanly. Nearly two-thirds of the work done in ribbon and throwing establishments is performed by women.

If the factories could be built and maintained so as to be well lighted, heated and ventilated, and if due regard was paid to the sanitary requirements for factory life, the silk trade would be one that the sanitarian could recommend as a healthful one.

The surroundings of the operatives in the factories is much better than those of people who carry on the business in dwelling-houses, as is often the case in Paterson and other towns where many silk weavers are employed. Knowing as we do the condition of the average house occupied by working people, we are forced to the opinion that no trade or occupation, like that of weaver or spinner, should be carried on in a tenement or other dwelling-house. The rooms in these houses are poorly ventilated and improperly lighted, and the operative is placed at a great disadvantage; hence, we should discourage the practice of turning dwelling-houses into factories. In Paterson there are hundreds of persons carrying on various branches of the silk business in their homes, and the loom or reel is set up in an already overcrowded kitchen or living-room. The operative, in these cases, is not only subjected to the unhealthful surroundings of the house, but is constantly tempted to carry on the work at unseasonable hours.

FLAX AND JUTE.

We now turn from the consideration of a trade which, when properly managed, is one of the most healthful, to the study of the condition of workers in flax and jute, and the contrast between the two trades will be noticed immediately.

The methods of manufacture and the effects upon the operative being the same with both flax and jute, they have, for convenience, been grouped together.

The scope of our review adopted at the outset will be followed, and the effect of factory life upon the worker will not be considered, our attention being devoted to the diseases caused by the special processes.

The method of manufacture is about as follows: The flax or jute is received in hanks, in its crude state, and is first "hackled" or drawn through a machine for the purpose of removing the seeds, lumps and other inequalities; also for the purpose of arranging the fibres in a parallel direction. The material is then reeled, spun or twisted into threads or cords of different degrees of thickness.

The details of these processes now claim our attention.

Hackling.—The hanks of flax or jute are drawn by the operative through combs made of long steel spikes, about one thirty-second of an inch in diameter, the objects being to arrange the fibres in a par-

allel direction, to split the fibre to as small a diameter as possible and to remove short threads and dirt. This work has always been done by hand, and no satisfactory machine has as yet been invented to supersede manual labor. This process has long been recognized as a very unhealthful one, and very few hacklers live to advanced life. In talking with men old in the business, the remark is often made that "they see nothing very bad in the occupation," and they point to a fellow-worker, here and there, who has lived long and has enjoyed fair health, although a hackler for twenty or thirty years. But the truth can only be ascertained by asking the question: "Out of twenty, thirty or fifty men who started in this business with you, how many of them are now alive, and how many of them have died of lung diseases or have given up because of the extreme danger?" A direct question like this brings the information that only from fifteen to eighteen out of a hundred survive, or enjoy good health at the age of forty. Now, what is the cause of this great mortality among hacklers? One has but to enter the hackling room and remain there a few moments, to derive the necessary information. The air is loaded with dust, made up of dirt from the flax or jute and minute fibres, and a breath cannot be taken without drawing into the lungs large quantities of this fine and irritating dust. A person entering one of these rooms from the fresh outside air is almost immediately seized with paroxysms of coughing, and for hours after returning to the ordinary atmosphere, the sputum is streaked with the particles of dust that have been inhaled.

Before considering the diseases caused by this dust, we will examine other departments of the flax mill.

Spinning.—The same condition of affairs obtains in the spinning room as we have seen in the hackling room. The air is loaded with a very fine dust, but the quantity is not as great as in the room where the hackling is done. Inspection of the machinery, the floors and walls of the room and the projections around the doors and windows reveals collections of this light and irritating dust, while the hair and clothing of the operatives are covered with the same material.

Enough has been said to indicate what the results are that follow the continuous breathing of this dust-laden atmosphere. Newsholme, in his "Manual of Public Health," sums up in a few words the verdict of the sanitarian on the occupation of flax-workers. He says: "Hemp and flax dressers inhale a dust which is peculiarly irritating;

and so fatal is the result that if a girl of eighteen commences with this work, and is regularly employed, she nearly always dies of consumption before reaching the age of thirty years."

It is very difficult to obtain from operatives an opinion as to the healthfulness of their trade, and we are often met with misleading or ambiguous replies. This trait of character is very noticeable when questioning flax-spinners, and we are answered that the trade is a healthy one, or we are told to look at the robust condition of the operatives who are engaged in the work. A somewhat casual study, however, soon informs us that the girls and women we see at the spindles are but the survivors of many who have died of disease induced by the trade.

It seems hardly necessary to go into any discussion of the reason why this trade is so unhealthful. Suffice it to say that the constant inhalation of irritating dust soon sets up a pathological process in the lungs, and this may result in a broncho-pneumonia running into destruction of the lung tissue—a group of processes classed under the general term, phthisis—or the irritating material acting as a foreign body in the lungs may start a form of inflammation which leads to an increase in connective tissue—pulmonary cirrhosis—which finally ends in destruction—necrosis—of the pulmonary tissue. The course of these two processes is very different, one being rapid, the other very protracted.

Knowing, as we now do, the cause of the great mortality among workers in flax and jute, what can be done to remove this cause and prevent disease? As there is prominently but the one factor of ill-health, the problem seems easy of solution, and is so theoretically, but practically there are many impediments to the successful management of a proper scheme. Fans so arranged as to draw the air from the rooms are employed, and if large enough and well adjusted much of the dust can be removed. But the trouble is they are, as a rule, not large enough and but imperfectly purify the air. It seems to the writer that to be successful the exhaust fans should be adjusted near to the hackler's bench or near the spinning frame, so that the dust shall be drawn into ducts as soon as it is thrown off. Where the fans are placed in one end of a room, the dust has to traverse the whole length of the room before it is removed and the air is only imperfectly purified, whereas if the ducts or pipes that lead to the fans were placed immediately over the source of the dust it would not enter the

air of the apartment, but would be rapidly and perfectly carried to the outside. This close application of exhaust ducts is employed over grindstones to remove the dust in knife-grinding and other processes where fine metallic particles are thrown off.

Where these fans may not be applied the operatives should wear masks or other forms of air-filters over the mouth and nostrils, so arranged that the dust is retained in a sponge or other filtering material fixed in the mask.

Wet Spinning.—Another process employed in flax factories remains to be described, that of wet spinning.

When the twine or thread has been spun in the ordinary way it is next taken to the rooms where peculiar spinning frames are set up; on these the thread is kept constantly damp by means of hot water applied in reservoirs that are adjusted to the frames. These reservoirs are partly filled with water, and steam pipes passing through it maintain it at a temperature of from 200° to 212° Fahr.

The rooms where this process is carried on, instead of being filled with dust, contain an atmosphere loaded with moisture, and this, collecting and condensing on the ceilings and walls, drops like a fine mist over the operatives, so that they are subjected to a vapor bath at all times. The floors in these rooms are of stone, and the workers to save their shoes, stand in their bare feet. The temperature of the wet spinning-room is always high; hence, in the summer, the women are compelled to work in a tropical climate, while in the winter the great contrast between the inside and outside air is provocative of bronchial and other catarrhal affections.

Besides these diseases the constant dampness is a frequent cause of rheumatism, both inflammatory and sub-acute.

It is difficult to remedy the defects in these rooms, and we can only suggest the trial of methods that will introduce large volumes of warm air, and at the same time remove the moisture.

The contrast between the two trades under review—silk and flax spinning—is very great. While one may be considered generally healthful, the other has always been deemed to be very dangerous, but more study is required before we can arrive at positive conclusions.

As was intimated in the beginning, these notes are merely intended as memoranda for future investigations. If we have clearly outlined the salient features we may hope that study hereafter will reveal more distinctly the causes of trade diseases, and enable us to suggest remedies therefor.

DISEASES OCCURRING IN MANUFACTURE OF RUBBER BOOTS AND SHOES.

There are in the Eastern and Middle States some eight or ten large rubber boot and shoe factories, and more than that number of smaller ones, employing an aggregate of perhaps 10,000 hands, and making from thirty to forty million pairs of boots and shoes annually. These employes comprise men, women and children.

The process of manufacture in general is as follows: The rubber, or gum, as it is called, imported from various tropical countries, is of several grades, the best coming from Brazil, and known as Para gum. The difference in grade is determined chiefly by the percentage of admixture with stones, dirt and other foreign substances, which varies from five to fifty per cent. or more. The gum is first "washed," to free it from the foreign material. This washing consists in being repeatedly ground between iron rollers, while a stream of water falls upon it from a height of a few inches. After this operation the gum appears in brownish sheets about the size of sheep skins, averaging, perhaps, a quarter of an inch in thickness, but very uneven, thickly and irregularly dentated, as if it had been chewed by some carnivorous animal. It is then dried by being hung for several hours in a moderately warm room, frequently the attic of the factory, where, in summer, the sun upon the roof affords sufficient heat. In winter some artificial heat is necessary; but this is an operation of little delicacy, and the degree of heat is not accurately determined. The sheets next go to a room popularly known as the "black mill," on account of the dirt and dust produced there. Here it is again ground by being passed between heated iron rollers, and this process is repeated until it becomes "fine," that is, it comes out in a thin, smooth sheet, the folds of which adhere together, forming a thick wad or roll. It is now "compounded," that is, it is mixed with varying proportions, according to the quality of goods to be manufactured, of litharge, white lead, whiting, resin, lampblack and sulphur. Another set of rollers receives and works it over until these ingredients are thoroughly incorporated with it.

The rubber thus prepared is distributed according to its quality and destination among various sets of rollers. Some of these receive, with the rubber, pieces of muslin, flannel or other cloth, and the pressure is such that the rubber is not only spread upon one surface of the

cloth in a continuous sheet, but is at the same time forced into the texture of the latter. This is afterward cut by machinery into the shapes necessary to form the inside of the boots and shoes. Other rollers are engraved so that the rubber which passes between them comes out stamped with the various figures seen on the outside of the manufactured goods. These stamped sheets are not pressed into cloth, but as they come from the rollers, are laid on muslin-covered frames, from which they are carefully transferred to the cutting tables, where they are cut by hand, with sharp-pointed knives, into the required shapes. The scraps left from the cuttings are returned to the rollers to be worked over into new sheets. Scraps from the rubber designed for the outside parts, containing no cloth, are, after being worked over, as good as fresh material, and are used as such. Scraps containing cloth, however, form a poorer quality of rubber, which is used for "filling" and for making boot heels. For the latter purpose, these "rag" scraps are ground and rolled into sheets, and these sheets, while still warm and consequently adhesive from the heat of the rollers, are made into rolls about three inches in diameter. With a handsaw, the rolls are cut into sections an inch or so in thickness, and these being placed in heated dies under a powerful press, are stamped into proper shape. A similar process is used to make the little projection on the back of the so-called "self-acting" rubber shoe.

The several parts of the boot or shoe, thus prepared, are called collectively "stock." This goes now to the boot-rooms and shoe-rooms, where it is made up by hand, piece upon piece, like one patch over another, being pressed upon a wooden last until the boot or shoe is completed. Before applying the pieces, their borders, and in some cases entire surfaces, are brushed over with a cement made by dissolving rubber in naphtha, but the main reliance in securing perfect adhesion between the inner and outer parts is in laying them accurately in place, and pressing them tightly together so as to exclude every particle of air. In doing this work, the *last* is held much of the time against the pit of the stomach, and the pressure on that point is so considerable that most of the operatives wear shields to protect, in a measure, the abdominal muscle sand internal organs. Boot heels, after being cemented and laid in position, are made firm by a sharp blow of a mallet.

The manufactured goods, still upon the lasts, are placed upon iron racks, furnished with grooved wheels, and running upon iron rails

laid in the floor. When loaded, these racks weigh several hundred pounds each. Most of the goods now go to the varnishing-room, where they are taken from the racks and brushed over with a mixture of linseed oil, naphtha and sugar of lead. They are then replaced upon the racks, and with a few that are not varnished, go into the ovens, where they are kept at a temperature of about 275° Fahrenheit for several hours. This is called baking or vulcanizing. The ovens are then opened, and as soon as the racks are cooled sufficiently to handle they are wheeled back to the boot and shoe rooms and their contents redistributed to the makers, who now remove the boots and shoes from the lasts.

The goods are now taken to the packing-room. The boots pass through the hands of the trimmers, who cut off neatly a portion of lining that in making has been allowed to project above the top of the boot. The necessary marks of the different sizes and varieties of goods are then made with stencil plate and brush upon the soles, the marking material being a paste of litharge, gum arabic and water. They are now strung together and packed in boxes for shipment.

Connected with the larger boot and shoe factories are box-making departments, which differ in no essential respects from the box factories of other shops. There are also engineers, firemen, teamsters, etc., whose occupations, though necessary to the manufacture of rubber goods, are not especially affected by the character of that manufacture and, therefore, call for no particular comment here.

The largest element of danger to health in this industry is the large quantity of lead used in compounding. From six to twelve pounds of litharge and white lead are added to every twenty-four pounds of gum. The object of this is twofold, to dry the rubber and to make weight. It is said that no other material that has yet been used can so well subserve the first purpose, but a much smaller quantity would be sufficient were it not for a popular idea that the heavier a rubber boot or shoe is the more pure gum it contains and, therefore, the better is its quality. The fact is nearly the reverse, but so long as the market demands extra weight, manufacturers will use extra quantities of lead, for the cost of a pound of litharge or white lead is scarcely a tenth of the cost of a pound of pure gum. The best grade of goods are stamped "pure gum," and contain less lead than others, but even these contain a large quantity, and such a thing as manufactured goods of really pure gum is unknown, because impossible. If the

public can be educated not to demand mere weight, the first step toward abating the evil will be gained. Then, and not before, it will be in order to seek for some substance that, itself innocuous, may take the place of lead as a drier in the compounding. The sugar of lead in the varnish is said to be used entirely for its drying qualities. Formerly it was not used, and the goods, after baking, were allowed to stand for several days before being boxed, but the custom of packing them immediately after finishing has made it necessary. In cool weather, comparatively little of it is used; in warm weather, more.

The persons liable to be injuriously affected by the various forms of lead used in rubber manufacture, are all who are directly engaged in that manufacture, from the time of compounding until the goods are packed for shipment. Those who are most apt to suffer, however, are the boot and shoe makers, the bakers and varnish boilers and the varnishers. The effects include, in different instances, all the manifestations of chronic lead-poisoning commonly known. The graver forms are comparatively rare, but wrist-drop and lead-colic are not infrequent, constipation is proverbially common, and the blue line upon the gums is almost universal among those who have worked for several years at the business.

The conditions under which the work must be done add to the danger of lead-poisoning. This is especially true in the boot and the shoe rooms. In these rooms the operatives stand or sit at long tables. The bootmakers are generally men and always stand. The shoemakers, usually women and children, sometimes sit, but more often stand. The bulk of the manufactured goods and the variety of motions necessary in making, involves a necessity for considerable room at the tables, so that the number of cubic feet of air space to each operative is generally much more than the minimum requirement for health in well ventilated rooms. But these rooms are often not well ventilated. A current of air upon the rubber impairs its adhesiveness, and the slightest moisture is even worse. Consequently, very little ventilation is allowed, and during the moist, hot days of summer, in particular, the windows are kept carefully closed. It is at this season that the greatest number of cases of lead-poisoning occur.

The want of proper ventilation and the heat are, in themselves, frequent sources of impairment of health, and it is not uncommon for operatives, especially girls at the period when their development makes

the strongest demand upon their environment, to break down from these causes independent of any influence from the materials used in their work. On an August afternoon when, about 2 o'clock, the racks come in loaded with boots or shoes hot from the ovens, with windows closed, the heat of the room becomes almost unbearable.

Perhaps the most common complaint of operatives, as to conditions supposed to impair health, is in regard to the smell of the naphtha used in the cement. In some cases it undoubtedly causes headache and nausea, impairs the appetite and interferes with digestion, but much of the ill effect commonly attributed to it is doubtless due to other causes already mentioned.

The pressure of the last against the pit of the stomach in many instances causes soreness of the muscles, congestion of one or more of the abdominal organs, indigestion or dyspepsia. A shield of leather or of some other material, worn over the abdomen, prevents these effects in part, but even this protection is sometimes insufficient, and it frequently happens that boot or shoe makers have to leave the factory on account of troubles so induced.

Like other industries involving the use of much machinery, this has a considerable number of accidents. Each pair of rollers in the black mill is attended by one or two men, or in some factories it may be by a man and a boy. It is their business to watch the rubber, loosen it from the rollers when it sticks, and keep it passing through in regular quantity. The rubber is sticky, and sometimes it happens that, through carelessness, a hand or arm is drawn between the rollers. Maimed men are not uncommon around rubber factories. Another accident that is quite common, though generally much less serious, is the crushing of the foot by a moving rack, as some person is crossing the track in the shoe or boot room, or in the packing-room. Children are the most frequent sufferers from this accident.

An accident of a different character is liable to occur in the making of varnish. On account of the danger attaching to this operation, it is commonly done in a small, detached building. A few years ago it was a trade secret, but is so no longer. The linseed oil and sugar of lead are put into a caldron set in brick, over a wood fire. So soon as the oil boils up, and before it can overflow the caldron, the fire is extinguished by dashing water upon it.

After waiting for the caldron to partly cool, forty-five minutes in cold weather and fifty minutes in warm, the naphtha is poured in.

The object is to introduce the naphtha at the highest temperature that is possible without setting fire to it. As it is known, however, that the point of safety cannot always be attained, the caldron is provided with a metallic cover, suspended a few feet above it, which can be dropped upon it in a moment by pulling a rope, thus extinguishing the flames. Just that moment, however, is sometimes sufficient to cover the unfortunate attendant with the burning liquid, with a generally fatal result. This accident does not happen very often, but it does occur in some factory every few years, and it seems one that might be entirely dispensed with without any real loss, as the varnish, after being made, is of no use whatever to the goods except to impart a gloss which lasts only until they are worn. Some unvarnished goods are now coming into market, and it is eminently desirable that all should be so.

The varnishers suffer more or less from their long hours of labor, which are commonly from 4 A. M. to 7 or 8 P. M. They are not kept constantly at work during this time, but have to be on hand in order to finish up the goods as they come in. It is, therefore, from being curtailed of sufficient time for sleep and necessary recreation, that they are liable to suffer rather than from actual overwork.

The materials for the foregoing report have been gained entirely from inspection of the Meyer Rubber Company's factory at Milltown, and from observation and attendance of many of its employes, who number about 450. Much is due to the courtesy and frankness of its superintendent, in affording information and every facility in his power for investigation. It is due to this gentleman, also, to state that in the conduct of this establishment, everything that is possible is done to promote the safety and comfort of employes. Wherever possible, the dangerous parts of machinery are protected by casings. The strong temptation which exists to employ young children is resisted more than in most similar factories, although many are found even here who ought to be in school. They are not allowed, however, among the machinery, as they are in some shops. Throughout the buildings and grounds, moreover, a degree of cleanliness and order prevails that would delight the eye of a sanitary inspector.

REPORT AS TO ASYLUMS, JAILS, PRISONS, PENITENTIARIES AND ALMSHOUSES.

BY THE SECRETARY.

It is well for the citizens of the State to recognize the fact that there are several laws on the statute book intended to secure some visitation and oversight of public institutions outside of that by the resident officers or by the directors.

This power was first given to the State Board of Health in respect to the sanitary condition of the various institutions. Additional legislation formed a Council of Charities and Correction for the special purpose of securing statistics as to the causes of dependency and crime, and advice as to the remedies. The last Legislature also recognized the agency of the State Charities Aid Association, by empowering it to apply to the Supreme Court for the appointment of visitors who could report on the conditions found in institutions. While the number of agencies would seem sufficient, there remains very much to be done in the interests of these divisions of our population. When it is remembered that they constitute about one in 70 of our entire population, and that the larger proportion of them is constantly returning to society, both on account of numbers and their especial significance as classes, they demand our most attentive consideration. They are not a self-managing class to the degree that other citizens are, and in a very significant sense are the wards of the State. Their number has a very definite relation to the economies of the State, when it is remembered that they cost it more than any other one item. Their condition is still more significant when it is known that they constitute the extra hazardous portion of the population. Invalidity, pauperism and crime are no hidden spectres, but have ever been a menace to the stability of governments. This is especially true in such forms of government as our own. Their influence is not confined to the individual. They represent families and communities.

They represent often a heredity for the future even more than of the past. They are a factor with which the State must deal far beyond the simple idea of detention. As no asylum would venture to exist without some effort at relief or cure, and without some study with respect to prevention or limitation, so no almshouse, jail or prison has a right to exist without effort and study in the same direction. While this is admitted as a statement, it is not very actively operated as a fact. Yet it is an advance that by various agencies we are permitted to get some insight into various conditions, to suggest remedies and where they are not readily adopted to make a sentiment of healthy public opinion that will eventually secure results.

As a rule this Board has been seconded in its suggestions by the various institutions. The sanitary management of the State asylums is under efficient oversight. Neither of them at the start was provided with the needed structural arrangements. So far as the Trenton Asylum is concerned, the sewage is well removed from the buildings, although there is some criticism as to its final disposition by those residing near. The heating and ventilating apparatus is in accord with modern improvements, and it is realized that no perfection of apparatus can take the place of skilled oversight.

In the Morris Plains Asylum much of the system as originally completed is now of questionable perfectness while the ultimate disposal of the sewage was left to tentative measures. The Managers have recently adopted a system which, in its general features, was approved by this Board. Much of its efficiency will depend on construction and management as to which the Managers provide. In most of the eight county asylums of the State valuable improvements have been made. In most of them we have found such defects as required specific written statements as to them. We do not recall a single instance in which the main improvements suggested have not been complied with and sometimes at considerable expense. We can point to instances in which great evils have been remedied and great changes inaugurated in the management of inmates. Occasionally those in charge fall into modes of management that they approve only because they have become used to them. Thus one asylum holds the idea that it is not safe to have washbowls or basins of any kind, and so the patients wash from faucets. In another case it was held that bedsteads are not safe in a jail. We do not cease to regret that county asylums were authorized for the smaller counties. The line of separation between the paupers and the more quiet insane is not well defined.

Accidents, sexual and otherwise, occasionally happen, for which the half-demented victims are not so much to be blamed as to be pitied. While we meet many evidences of kindness and good intent, it can not always be said that classification and management are in accord with the advances that have been made in the care of alienism.

The State Prison is under such discipline and management as secures for it good sanitary administration. It would be well if a map of underground pipes and connections showed all the relations of pipes, traps, etc. There is reason to believe that, in the older parts, the structural conditions are not as they should be. While the prison has great advantage in its ready place for discharge, sewers or pipes as constructed years ago often become sources of foulness. There is also some defect of ventilation in parts of the structure. At times the overcrowding of the cells is injurious. The two penitentiaries of the State are in good sanitary condition. It is in contemplation to make some change in the Hudson penitentiary as to closets, in the addition.

The greatest sanitary defects are found in the jails of the State. In the more crowded ones, such as those of Hudson or Camden county, there is need of change in structure and in the assortment of inmates. So long as the jail is a place for the promiscuous herding of vagrants, drunkards and the motley crowd of those arrested on minor offenses, or who cause themselves to be arrested only that they may have a home, it is impossible for our jails not to be the causes of more crime than they prevent or punish. By the board system of many of the counties, the most profitable inmates are those who, spending two nights and one day, eat nothing and pay for two days' board. Sheriffs or wardens who desire to do their duty should not be made dependent on such perquisites. The putting of four, five or six in one cell, and the full corridors of the daytime, with the bad conversation and conduct inevitable in such a method, must continue to make most of our jails a constant menace to the health, morals and peace of the State. It is impossible to maintain proper cleanliness under such conditions. The fuller jails come to be even in a worse condition than is conceivable to those who have not made examination. We had occasion, during the present year, to summon to the jail at Camden, for its inspection, the City Board of Health and the County Director and a few others. The scene will never be forgotten by any of the number. Garbage long unemptied, beds

and cells foul beyond description, linen unchanged for months, not a towel ever seen by inmates, and the general conditions of the dungeons, the corridors and the inmates, made it a scene scarcely to be credited, but for the number and character of the witnesses. The keeper, with great force, pointed to the character of the structure and of the crowds of occupants as the unavoidable cause. It is true that the vaults are wholly unfit for use. While there is no other so flagrant instance in the State, the jails of four or five other counties are but little better when the fewer numbers in them are considered. We are often able to improve them for a season, but there is too often relapse, because the structure of the cells, the association of the inmates and the promiscuous use made of the jails for every one strayed or stolen, drunk or crazy, vagrant or criminal, defies classification, order or cleanliness. Modern civilization ought never to allow the jail to be the pen or corral for all misfortune or vagrancy. The station house, the almshouse, the workhouse, the asylum, the charity home, the orphanage, have their uses. Separation is the first principle of successful management. Whatever views may be held as to the disposition to be made of long-term prisoners, all prison authorities agree that those under arrest and kept for short periods should have separate confinement. Such a system would break up our jails from being, as they now are, places for social resort and companionship to most of those who are now their guests. Until then, the sanitarian, the philanthropist and the State and government loving citizen must deplore a plan which makes more rogues than it punishes, and adds moral deformity to personal and structural uncleanliness.

The almshouses of the State vary much in their condition. The eight which have asylums in them, generally have the two under one management. Sometimes there is a separate building. In other cases the apartments are entirely distinct. In most of the county almshouses there has been marked improvement in general sanitary conditions. The greatest difficulty is to secure sanitary discipline in the bathing, clothing and habits of inmates. If there is a bath-tub, too many of the inmates cannot remember that they have ever used it. Hudson county has happily adopted a uniform method in its pavilion and requires attention to many of the details of personal cleanliness. In many of the almshouses there is not sufficient change of clothing. Even the shoes or *outer* garments that have been worn for eight or ten

years come to need replacement. Grease and dirt need changing as well as rags. Children are too often left to the loose associations possible in these almshouses instead of being separated so that they may not grow up to be paupers. Statistics are constantly showing that alms-care may relieve pauperism in some, and cause it in others. If all of the almshouses of our State could adopt methods now well understood and in actual use in the more advanced institutions, it would greatly reduce the amount of dependency in the State. In the reduction of this we should also have a reduction of invalidity and crime.

It is apparent that the visits made to institutions are of great service. They are made without previous notice and most of the overseers are anxious to meet with approval. Here and there a steward is insensible to the fact that his house is meant to be something more than a mere reception place for the poor, and so cannot be awakened to the idea that pauperism may be increased or diminished by almshouse management.

Some of the houses, like that of Burlington county, receive all the poor and give no outside help. In such, the group found represents the class condition of paupers in the county. In other cases, as in Trenton for instance, there is much outside help, and the almshouse contains but a very small part of the paupers. There is still a great work to be done, both by legislation and voluntary aid for the invalid, dependent and penal population of the State, and we still urge that from a sanitary, economic and social standpoint, greater attention be given thereto. The various reports of this Board, circular 29, the reports of the Bureau of Labor and Statistics, the report of Mr. Meyrick and the reports of the Council of Charities and Correction give valuable information relating to this subject.

ABSTRACTS FROM THE PAPERS AND DISCUSSIONS OF THE NEW JERSEY SANITARY ASSOCIATION.

SESSION OF 1886.

BY D. C. ENGLISH, M.D.

The twelfth annual meeting of the New Jersey Sanitary Association was held in the Assembly Room at the State House, Trenton, commencing Friday morning, November 12th, at 10:45 o'clock. Prof. James M. Green, of Long Branch, the President, in the chair.

TRAPS AND TRAP VENTILATION.

The first paper was upon "Traps and Trap Ventilation." The author being I. C. Bayles, M.E., of Orange. Mr. Bayles first described the trap as simply a bend or enlargement of a waste-pipe so arranged as to hold a small quantity of water. The function of this water is to close a branch waste against the free passage of air currents. If more than this is expected of a trap it is sure to disappoint the expectation. The more complex the structure of a trap, with a view to making it secure against influences tending to empty it, the greater the certainty that it would become a conservator of filth and in itself a nuisance. The writer's observation and experience led him to believe that the simplest form of trap, the "S" and half S, adequately vented from the crown of the bend, is the best, all things considered. A vent as large as the trapped pipe is adequate under all conditions. Traps are sometimes placed in positions which render vents of doubtful value. The venting of traps has a double purpose. It is intended to save the seals, which are liable to displacement by the creation of a partial vacuum in the waste-pipe system beyond them, making a demand for air which, if supplied through the trap, carries enough water out to leave

it unsealed. It is also intended to afford an outlet for foul air which might otherwise accumulate in the branch waste below the trap, and finally pass its seal by the well-known process of the absorption and release of gases by water. When the objections to the trap-vent are analyzed, they will be found to be advanced in the interest of patented traps. Commercial considerations underlie most of the current literature of mechanical hygiene. A large part of the inventions which are crowded upon the public notice are made, not because they are needed, but because by persistent advertising they can be made a source of profit. Most of them originate with persons ignorant of the practical problems encountered in plumbing, and who seek to remedy difficulties which exist only in imagination. Traps to "exclude" sewer-gas belong to this class of inventions. The attempt to bottle up bad air in pipes has long been abandoned, and progress tends steadily in the direction of multiplying easy and safe outlets for it. It is certainly a delusion to think it possible or desirable to exclude sewer-gas by mechanical means. Having examined on the average seven new traps a week for the past ten years, the writer does not hesitate to put it on record as his opinion, that the simplest trap is the best, and that any complication introduced in its construction tends to impair its value. * * * A house drain should not be trapped. Many believe that the householder should interpose a trap between his house and the public sewer. A trap of any form there, he believed, will retard the sewage flow, and create worse conditions than those sought to be escaped from. * * * There is no difference of opinion as to the impropriety of trapping the *soil-pipe* at any point, the old practice which interposed a trap at the foot of the rising line where it turned in the direction of the sewer having been wholly abandoned and with good reason, but a good many cling to the idea that the householder should interpose a trap between his house and the public sewer. * * * Granting that the conditions found in the sewer are bad, it is my experience that those created by the house-drain trap are worse. The obstruction to the flow created by the presence of a trap causes the waste water to deposit, in the pipe above the trap, its grease and solid matter which accumulates in strata of festering filth, inducing conditions worse than those which are found even in neglected and dirty sewers. * * * An untrapped house-drain with a sufficient fall is usually clean. The water it carries enters it with a velocity due to a vertical fall of ten, twenty or thirty feet, and usually reaches

the sewer without depositing its burden. A trapped house-drain carries the sewer in its worst estate into the dwelling and establishes a domestic sewer-gas manufactory in the cellar. After mentioning other objections to the house-drain trap, and expressing the opinion that the arguments for it would not stand the test of critical examination, Mr. Bayles recommended very strongly in every case, that the house-drain and soil-pipe be made one, opening at one end into the sewer and at the other to the sky, insisting that it shall be free from leaks, with water and gas tight-joints. In a tube open at both ends there can be no pressure of gas or air to displace seals or force an outlet through lateral branches. With such a pipe he would connect his branch wastes in the usual approved method, giving each fixture its own hub, and not making the water-closet trap the medium of discharge for bath and basins. These branch wastes he trapped, and, so far as possible, he gave each trap a vent, chiefly with a view to promoting a free circulation of air through the whole waste-pipe system. This, in his judgment, is all there is of safe plumbing.

Mr. G. P. Olcott, C.E., in opening the discussion on this paper, said he was compelled to differ with the author when he took the strong ground that a trap should never be used between the house and the sewer. He was not in favor of a cast-iron rule here, for he believed, with a competent engineer in charge, it should be left to his judgment. He believed there is more trouble with vents from soil-pipe and fixtures by the position of the top of the pipe as to location and elevation. Often the vent is carried to the roof, but not to and above the highest point, and so it does not carry the foul air away from the house, and especially when the air is heavy it will descend and enter the first window. He said he would never allow a vent to be run into a chimney flue, but be carried as far as possible inside the house, then above the highest point of roof. The vent from traps can be carried without special reference to the highest point, but it is better if they are. In no case is galvanized iron safe. Nothing but cast-iron pipe with tight joints should be used. He did not believe a vent from cesspool or sewer outside of a house is of much value except on a very warm day.

Dr. E. M. Hunt thought the paper a valuable one, but was not prepared to go as far as Mr. Bayles in rejecting the trap in all cases. He hoped we should have it fully discussed, especially by the engineers present. He agreed with the writer that the "S" trap

was the simplest and is better than most of the more complicated patented traps.

Dr. W. K. Newton, of Paterson, in discussing the paper, said that he saw little use for the running trap on the main drain, just inside the house wall, for the following reasons: 1st, It is stated that the object of this trap is to exclude sewer-gas. Now, it is a well-known fact that the air of the soil-pipe inside the house is much more foul than that in the sewer; hence, the trap is of very doubtful utility. 2d, This trap impedes the flow of sewage from the house, and also serves to retain solid materials and grease. The speaker was in favor of greater simplicity in house plumbing, and said that this should be the great aim in devising a system. He also said that the fresh air inlet on the house side of the running trap was also of doubtful utility, because it often acted as an outlet, and hence interfered with the circulation of air in the house-pipes. In summing up, he said that a system of house drainage should only need the following: 1st, A cast-iron pipe from a point outside the house where it connects with the sewer to run of undiminished size through the house, and at least two feet above the highest point of the roof. 2d, To this is attached all water-closets and fixtures. 3d, All basins to be trapped, and these traps provided against siphonage, either by a proper vent-pipe or by means of some anti-siphon device. 4th, Water-closet traps should be provided with vent-pipes of large calibre. 5th, Great simplicity of arrangement and the minimum number of fixtures.

Mr. J. C. Pumpelly, of Morristown, in a few remarks, urged the greatest simplicity compatible with safety.

C. Phillips Bassett, C.E., of Newark, said that, in a system that he had approved, the trap was abolished, but he was not prepared to say that the trap should never be used between the house and the sewer. The difficulty is that a very small per cent. of pipes are tight in their joints, and, of course, without good traps they are dangerous. A draining system with traps may also be dangerous if not properly constructed. If your main sewers are imperfect the trap is necessary. There are some traps which will stand siphonage and back pressure.

Mr. Bassett expressed his dissent from the views expressed by the author of the paper, and his belief is that in very many cases the outside trap and vent-pipe must be used.

DISPOSAL OF HOUSE SEWAGE.

The second paper on "Disposal of House Sewage in Districts not Provided with Sewers," was then read by the author, C. Phillips Bassett, C.E., of Newark. He thought that it is not so much that we need more or even that we need better methods than are at hand, but that present knowledge be in some measure recognized and applied. He then dwelt upon the character of house wastes which combine to make up house sewage—of human excrement which may be the medium for transmitting distinct disease germs; washings from the bath and laundry which may be equally dangerous, and the multiform organic wastes of the kitchen, the pantry and the table. He believed the refuse from the table and the kitchen sink became as dangerous sewage as that which flows from the water-closet. He dwelt upon the importance of this question and the careless indifference that had existed in remedying these great evils which so increased our death-rates, and declared that there is not a town in the State where the house sewage is properly removed from even a majority of the houses in the closely-inhabited districts. He then considered the subject under two divisions: 1st, Districts unprovided with sewers where such lack can be wisely replaced by other appliances; 2d, Districts unprovided with sewers, for which the suggestion of any other remedy than a properly equipped sewerage system would be idle. We forbear making further report of this paper, as it will be found in the annual report of the State Board of Health. (Page 65.)

We quote, as worthy of emphasis, some of his concluding remarks: "It must be realized that public health is not a matter to be trifled with by reckless individuals who are content to jeopardize their own existences in the midst of disease-fostering conditions. The sooner the need for a centralizing, controlling power, which is interested not only in the sanitation of the wealthier and cleanlier sections of the town (where proper sanitary conditions are, perhaps, most liable to exist), but also among the hovels and lower classes, is recognized and secured, the better. The weakest link of a chain measures its strength. The vilest section of a town may be the measure of its immunity from disease or contagion. * * * Anything which increases the demand for honest and intelligent protection and preservation of health, merits our encouragement and support. If we then run counter to custom

and present practice, we must meet the issue squarely and manfully. Reforms are not readily secured."

In the absence of Prof. Chas. McMillan, who had been expected to open the discussion on this paper, on motion of Dr. E. M. Hunt, Prof. C. F. Brackett was requested to do so. Prof. Brackett said that not having expected to open the discussion, and having heard only a part of the paper, he would not occupy much time, but he desired to say that from what he did hear of the paper he thought it deserved hearty commendation. Every building, in devising its arrangement of pipes and fixtures, must have its individual case considered, very much as the physician has to consider the case of his patient. It is quite impossible to lay down fixed and unyielding rules which will be of universal, or even general, application. The arrangement of rooms, the height of the floors above the sewer or cesspool, the character of the sewer, the slope of the ground, and it may be many other factors must be taken into careful consideration in devising such conveniences as modern life demands, if we would possess them in safety.

Mr. J. C. Pumpelly spoke of the decided and persistent opposition to the introduction of a system of sewerage in Morristown. The vast number of cesspools there was getting to be a very serious matter, especially since the introduction of their excellent water-supply. He would like to know more about the cremation of sewage. Mr. Bassett replied that while that was available in disposing of garbage and solids, it was not so practical for the disposal of liquids.

Dr. E. M. Hunt stated that in Montreal a cremation furnace had been used with good results both for solids and liquid sewage, but while we may be agreed as to the methods to be adopted in our large cities, the most practical question is as to the best plan for small towns and villages. It is easy to manage a dry privy, but we need a separate system for liquids, and he knew of nothing better than the small-pipe system. Rev. Mr. Ballard, of Ocean Grove, spoke of their experience in Ocean Grove, and then of the difficulty they had had at Pitman Grove, where there was no descent of ground and no stream to carry away excreta. It was a serious question there when they had from four to ten thousand people there two or three months in the year. That the garbage was taken away every day and partly fed to hogs, and the remainder was composted. That formerly the privy vaults were trenches with a board which could be lifted at the back,

over whose deposits dry earth was sprinkled three times a day, but that the plan was objectionable because of the odors arising therefrom. That the last plan adopted was to have cemented vaults, say 20x16 feet from 14 to 15 feet deep, into which all excreta, chamber slops, &c., could be placed. They were so constructed that the contents could be pumped into barrels upon a wagon. So long as the contents did not come within five or six feet of the surface they were nearly free from odor.

Adjourned.

AFTERNOON SESSION.

At 2:15 P. M. the meeting was called to order and the President introduced Dr. E. S. McClellan, who exhibited and explained the action of his trap with a fresh air inlet. This is the device—fresh air inlet for traps—which Mr. Bayles, in his paper, speaks of as working better often than a vent-pipe, responding quickly to a demand for air, but as promptly closing against a current seeking escape through it.

PHYSICAL LAWS OF PIPES.

Prof. C. F. Brackett, LL.D., of Princeton, was then introduced and delivered an interesting lecture on "The Physical Laws of Pipes." This lecture will be found elsewhere in this report of the Board of Health. (Page 81.)

C. P. Bassett, C.E., then opened the discussion. He said that he did not deem it necessary to add much to the address that had just been delivered on the subject; that it was just such clear thought and careful deductions which had drawn sanitary science out of the haphazard and guess work which had until recently characterized the work now confessedly within the province of the trained and educated sanitary engineer. The use of a 4-inch house drain in the place of an 8 and 12-inch, or an old brick or stone channel, rough and open-jointed, was one of the progressive steps in sanitation only made possible by acquaintance with the laws of hydraulics and their practical operation. The same discernment has introduced sewers with cleansing flow and apparatus for flushing, in place of the elongated cesspools,

and, in fact, is the corner-stone of all sanitary progress. It draws the line between the engineer and the plumber, the expert and the practical man, &c.

DUTIES OF LOCAL INSPECTORS.

The next lecture was then announced on "The Duties of Local Inspectors, How Best Performed and Details of Method," by Dr. Henry Mitchell, of Asbury Park. Dr. Mitchell, 1st, Urged that training be provided for local Inspectors, and that in the near future no appointment shall be made to this office until a satisfactory examination shall have been passed by the applicant. 2d. He showed the benefits to be derived from a detailed record of sanitary inspection, giving the duties of Inspectors and methods of work somewhat in detail as it is carried on in Asbury Park and elsewhere. He thought the tax-payers have a right to demand that we give them for Inspectors, not novices in sanitation, but intelligent, competent men. The laws of New Jersey authorize sanitary inspection and local Boards have the power to appoint Inspectors. The latter should know thoroughly every detail of every building in his district. He should be acquainted with the vital statistics of every dwelling in it, and the condition of every lot and street, &c., and to him should be known the drains and sewers, their contents and ventilation. All this information should be recorded and classified and filed in the office of the Board of Health for availability. When not attending to complaints, the Inspector should be going over his district, book in hand—not to invade dwellings, but to study their construction. A good record of the sanitary condition of towns would do more for the promotion of the cause of public hygiene than any other single means.

Dr. T. R. Chambers, of Orange, was introduced, and opened the discussion. He said that while he believed in the education of Inspectors for service in cities as had been recommended, we must, in his opinion, discriminate, recognizing the fact that the rural Inspector's service differed from that of the city. Any extended course of training for the former seemed to him impracticable. A good New Jersey common school education as a basis, a polite demeanor, enthusiasm in the work, dispatch, tact for tracing the ultimate cause of the trouble and ability to apply the remedy, these were the points necessary for a good Inspector. The recent graduate from college was suggested as good material from which to secure such men.

Rev. Dr. Ballard did not think the Inspector should be necessarily highly educated. Men of good common sense were needed to follow the instructions of the Board of Health. He had known a good policeman to make an efficient Inspector. The members of the Health Board should have the knowledge spoken of.

Mr. G. P. Olcott, C.E., questioned whether a college for township committees was not more needed than one for Health Inspectors. He argued that politics should certainly not be considered in making appointments.

Mr. E. G. Harrison, of Key East, offered the following:

"*Resolved*, That a committee be appointed to examine into the practicability of recommending a plan for the instruction of Sanitary Inspectors in the interest of public health and the enforcement of the present laws and ordinances relating thereto, said committee to report at the next annual meeting."

This resolution was referred to the Executive Council.

Dr. J. Y. Simpson, of Orange, spoke of their Board as being, in his judgment, well constituted, being composed of two physicians, an architect, a plumber and a lawyer. He thought one of the difficulties in getting efficient Inspectors was that the salaries were so small you could hardly expect to secure a skilled man. About $100 only is paid in their town.

The subject was further discussed by Dr. T. W. Harvey, of Orange, J. B. Pudney, Esq., of Passaic, and others.

PRESENT AND FUTURE WORK FOR HEALTH BOARDS.

The President then introduced Dr. E. M. Hunt, Secretary of the State Board of Health, who spoke on "The Work of the Present and the Immediate Future for New Jersey Health Boards." After a rapid notice of the advances made in organization and legislation in recent years, Dr. Hunt claimed that the time for diffusing information had not passed, but that it now had become (*a*) the special province of local Boards to do this work. The reports of the State Board and circulars by the thousands were at the command of the local Boards if they would systematically circulate them. These had been carefully prepared and were on practical subjects. It is found that they are extensively read when thus supplied. The press is also generally

ready to aid the local Boards when those locally informed contribute thereto. Next, (*b*) care as to judicial action should be exercised. Have clear, right and reasonable ordinances, right modes of procedure and prudence without timidity. Only seek new legislation when essential. The powers now given to local Boards are probably all that ought to be asked, except that somehow or somewhere there ought to be more control over wrong building and defective plumbing. In some cases, where for local reasons local Boards are deterred from doing their duty, it would be wise to give the State Board power to complain and secure action through chancery proceeding. (*c*) The appointment and training of Sanitary Inspectors was then insisted upon by Dr. Hunt. He referred to the fact that diplomas are awarded in six colleges in England for accomplishment in this line. Such an officer, though he may only receive now $100 a year, will soon become so valuable that he will command $1,000 or more. One in this State is now receiving $1,200 per annum. He referred to the excellent work now being done in Asbury Park, Paterson, Newark, and to the value of the records they have on file giving the sanitary condition of a large proportion of the houses in those places. The law requires Inspectors for all towns of over 2,000 inhabitants, and permits their appointment in all towns and townships. Inspectors are not merely for detecting nuisances, but for *preventing* them also. (*d*) Regular reports by Inspectors and a record of places visited, of work done and of action advised, must be made. The Board which requires system will not find itself without important work for each weekly or monthly meeting. (*e*) Next, local Boards should in every way avail themselves of the State Board, its Inspectors, its advice, its library, &c.

Dr. Hunt reminded the Association that the State Board, its library, its Inspectors, and its advice and co-operation are at the command of the local Boards, and subject to their call.

Dr. Hunt then introduced to the Association, Mr. J. J. Powers, C. E., of Brooklyn, N. Y., who spoke on the comparative value of several traps and on the disinfection of sewage. Mr. Powers gave several practical illustrations with appliances which he had brought with him. (See Mr. Powers' article, page 75 of this report.)

Mr. J. C. Pumpelly spoke of the importance of enforcing the law requiring the appointment of a Health Board in every city and town.

EVENING SESSION.

The evening session was held at 7.45 o'clock, President Green in the chair. A large number of the young ladies of the State Normal School were present, also a larger attendance of the members of the Association. Prayer was offered by Rev. G. C. Maddock, of New Brunswick, who was invited to sit as a corresponding member.

THE PHYSIOLOGICAL SIDE OF EDUCATION.

Vice-President W. K. Newton, M.D., then took the chair, and announced the annual address by the President, Prof. James M. Green, on "The Physiological Side of Education."

After an introduction, in which he spoke of the vigorous growth of the Association in numbers and influence, and of the efficient work of the State Board of Health, Prof. Green said it was his special prerogative on this occasion to deal with a subject relating more especially to the schools, reminding the Association that the principles that are there implanted and the habits that are there inculcated are to become the principles and habits of the adult generations to follow. He spoke of the abundant literature on the subject of school sanitation our State possesses; that what remains is the faithful working out of this knowledge in practice; that good plans for the execution of the work have been submitted and are in able hands, and he believed the time is being pushed rapidly forward when every teacher will feel the necessity of sanitary care, both for the security of her pupils and her position. Believing that there is one important branch in school economy which has not received sufficient consideration—the arrangement of our courses of study and requirements with due regard to the physiology of the child—he had been led to devote the remainder of his address to remarks on "The Physiological Side of Education." Disclaiming any attempt to travel new ground, he should be satisfied if he could add emphasis to other's views and help to make more general the knowledge of the few. He referred to the educational hypotheses of Socrates and Plato as having been wrong, but that their lives were consistent with their doctrines. Their teachings became deeply engrafted upon the human mind and subsequent philosophy has borne their imprint. The Cynics, Antisthenes and Diogenes were

strong types of the logical results of their teachings. They considered the body the proper recipient of all manner of neglect. * * * It is true the physical received training at times, as in the gymnasia, but this training was on the basis that a sound body was at times useful as well as a sound mind, rather than on any basis of the relation of mental to physical functions. * * * He then spoke of Epicurus and his disciples as the first to offer a formal protest to the Socratic school, and from *this* school of thought came Bacon. After speaking of Bacon and his followers, the teachings of Professor Bastian, Dr. Maudsley and Dr. Carpenter, he said:

"It is plain that our educational systems should conform to physiological laws, not on the principle that a good body is useful as well as a good mind, but on the principle that a good body is necessary to a good mind. * * * As the little child cannot endure long muscular tasks without detriment, so it cannot perform long mental tasks without injury. Dr. Ray says: 'The power of the human brain is affected by age. I feel quite safe in saying that the school instruction should seldom begin till the sixth or seventh year, and that for the youngest and for all not favorably organized, six hours is certainly too long. If the equilibrium between the action of the various organs is disturbed by the excessive exercise of any one of them, an advantage is thereby afforded to any morbid tendencies that may be present in their struggle with the vital powers.' How do these statements sustain our habit, yet almost universal, of making the school hours for the little ones the same as those for the advanced pupils? * * * The growth of the brain and consequent growth of the mind, at least in its earlier stages, is the result of physical laws, of impressions conveyed to the mind through the senses. This pleads for the scientific mode of instruction, the proceeding from the known to the unknown, from the subjective to the objective, in strong contrast to the abstract methods of the older school. The slower processes of introducing objects into all our school-room work as the concrete embodiments of our mathematical and other abstract conclusions, as well as the tendencies to coindustrial training are hopeful signs in this direction. The investigations of Prof. B. P. Bowne go to prove that all our phenomena, both mental and physical, may be reduced to one or another phase of dynamics. This admitted, it must be conceded that the mental phenomena are of greatest force, and therefore most exhaustive, and must be attended with greatest care as to rest and nourish-

ment. With what added force come all our hygienic teachings and principles, when we regard them as not merely productive of physical health, but necessary to our mental growth. With what increased zeal will we turn to an investigation of physiological laws when we discover them to be parallel to our mental laws and necessary to them. * * * The teachers go forth as sowers and reapers, and if they bear the tables of hygienic principles written upon their heads and hearts, they will return laden with rich sheaves for the harvest home."

Upon motion of Dr. Benjamin, the thanks of the Association were extended to Prof. Green for his able address, and on motion of State Superintendent Chapman, it was resolved that the President be requested to furnish a copy for publication.

PHYSICAL RESTRAINT AND RELAXATION IN THE SCHOOL-ROOM.

Prof. Charles Jacobus, Superintendent of Public Schools, New Brunswick, was then introduced, and read a paper on "Physical Restraint and Relaxation in the School-room."

He considered, I., restraint under three heads: (*a*) Its nature, (*b*) its disadvantages, (*c*) its benefits. Restraint is the act of restraining (or hindering) from motion, in any manner. Physical restraint, therefore, is the hindering of the motion of the bodily organs, or more fully it is bringing into a state of quietude, or rest, and keeping there the organs which otherwise would find their natural function in activity. * * * Restraint, in the sense in which it is employed in the subject assigned him, implies hindrance from motion through the agency of some power or person exterior to self, for, a *cripple* confined to one position, or an *invalid incapable* of free movement would *not* be under "*restraint,*" in the sense in which we use it, as their condition alone, independent of external agency, prevents freedom of motion. Physical restraint in the school-room is necessary to insure order, Heaven's first law, for order cannot exist among children unless they be under restraint. School-room restraint generally requires that a child that has been under little or no restraint previously shall, *all at once*, enter upon an entirely different method of spending the time from that which has been in vogue. Prof. Jacobus forcibly illustrated this by an incident during his summer vacation. He saw in a rough board inclosure, about 20 feet square, in the spa-

cious grounds of a large hotel, a beautiful fawn that had by some means been caught and transferred from the large liberties of its mountain home to this miserable pen. Instead of the cool retreats of the forest, it was exposed to the rays of an August sun, without any protection, flies adding to its misery, &c. It was under *physical restraint*, and with that restraint was nothing that could even approximately compensate for the lost liberty of its native haunts. The young colt was also cited as an illustration. "Something like this, *sometimes* is the transfer of a child accustomed to the largest liberties, to the too frequently rigid conditions of the school-room. No wonder a child chafes when such a change of life is experienced! It is really wonderful, in the rigid exactions of the school-room in this respect in years past, that so many have survived the practice with so little apparent harm. It shows at least the great elasticity of youthful nature." He spoke of the child commencing school attendance and undergoing for twelve years this restraint at the period of what is naturally the greatest activity. The fact that the child does not rise in rebellion at the prospect is because it does not realize all that it must endure of physical restraint. The buoyancy of youthful natures, the frequent relaxing of the requisitions for restraint in recesses, intermissions and weekly holiday of Saturday, go far toward ameliorating a condition which otherwise might derive anything but hope or comfort from a consideration of its future course. The time has been when a rigid restraint has been put upon the child upon the *threshold* of its school life, with no relaxation accompanying (except at unreasonable intervals) to vary its grinding monotony. * * *

2d. *Its disadvantages.*—Chief among these were cited, the distaste which is created even in young minds for the atmosphere and future legitimate work of the school-room; disadvantages which leave in their wake a long train of accompanying evils, such as confirmed lack of interest, habits of slothfulness and mental inactivity, and a condition generally very much below par, even morally considered. These are some of the disadvantages, while the physical results, caused by physical restraint, from the length of time, the improper positions, and lack of adaptation of desk or seat to size of pupil, may be in the after-growth of a child of no unimportant character. * * *

3d. There are some benefits, nevertheless, connected with this physical restraint. The conditions necessary for intellectual development in after years of study will be more carefully observed because of

required observance of similar (*if somewhat severer*) conditions in early years. The plainest demands for *order* and *propriety*, attention to which is necessary for realizing the most profit, either from single recitations or extended courses of study, these demands are partly satisfied by the advantages resulting from physical restraint, though the fact that these might be secured by other methods is by no means to be denied—methods involving more bodily activity in connection with school-room life, and so uniting brain-work with bodily movements as to make the latter furnish a zest for the former.

II. In considering the question of *proper* physical restraint, there will necessarily enter the subject of relaxation. The sudden cessation of a state of motion or activity, even with respect to material things, was then referred to as dangerous, and instances cited, and a gradual passing from one condition or extreme was urged as necessary; if we pay no regard to this, the physical health and the mental condition will sooner or later pay the penalty. Relaxation (in the sense in which it is here used) is a state or occupation intended to give bodily relief. Sometimes it means nearly the same as bodily repose after unusual or even ordinary physical labor. But in connection with physical restraint in the school-room, and as an offset to it, it may comprise not a state of bodily repose or quietude, but a condition of greater or less activity of the various muscles and organs of the body. Prof. Jacobus then spoke of the necessity of a wise combination of restraint and relaxation. "There are some teachers," he says, "who have combined the various exercises of their scholars so happily; who have so much room for the introduction of exercises calculated to relieve the body, and seats and desks so well adapted to the size of their pupils, and especially rooms of such capacity and so well ventilated, and with a proper number of scholars, as to leave little to be desired, and to reduce the evil generally resulting to a minimum." He quoted Fitch's remarks in his "Lectures on Teaching:" "If provision be not made for giving lawful vent to a scholar's personal activity, and he is called to maintain a confirmed position for an unreasonable time, his restlessness and disobedience are the teacher's fault, not his. * * * The physical activity so natural to the child needs to be directed, not restrained. You cannot stop its flow without doing great violence to the child's mind and heart."

"He who stops a child in terror,
Stops its play or stills its song,
Not alone commits an error,
But a grievous moral wrong.
Then give it play and never fear it,
Active life is no defect,
Curb it only to direct.
Would you stop the flowing river?
Think you it would cease to flow?
Onward it must run forever,
Better teach it where to go."

Prof. Jacobus then discusses at some length the great value of physical culture, gymnastics, calisthenics in the school-room as an offset to physical restraint. The need of improved and increased facilities was urged. He spoke of the service which recent manuals of directions have rendered, and how a few enthusiastic and determined teachers have made their work easier and more productive of good (mental and physical) to their pupils by zealously learning and putting into practice their comparatively simple instructions. He also spoke of the plan suggested for the solution of the problem through industrial education as worthy of consideration. He agreed with Prof. Morton that "the great danger to the youth is that he has too much idle time," and he believed that the best teachers are those who keep their scholars at work and teach them to love to work. "The toil we hate fatigues us soon." He was glad that the colleges and higher institutions have been waking up of late to a greater demand for attention to the physical. He believed the lower grades of school and academic life ought to be embraced in the list, especially when we realize that a very small per cent. of the youth of both sexes go to higher institutions and many drop out before the ordinary public school course is even half completed. He asks, "How much greater the need of proper care for the ninety and nine in those years of life when they are most susceptible to physical restraint and before any improper physical manifestation or tendency shall have been confirmed or strengthened?" He would insist that all who enter the ranks of teachers shall be duly qualified from their knowledge of the system of instruction and the nature of their pupils to know how far and how well the former is adapted to the latter. He expressed surprise that the National Teachers' Association had given so little attention to this subject. While it has been considered indirectly in some excellent papers, there has, so far as the

records of their meetings show, been no paper presented on the symmetrical development of mind and body. He commended Dr. Hartwell's "Physical Training in Colleges and Universities," published by the National Bureau of Education. Prof. Jacobus urged the positive need of more room for scholars and fewer scholars in a room, of proper warmth and especially of light and ventilation. He also referred to the uncomfortable and unhealthful postures in uncomfortable seats as needing correction. Also, as one of the greatest present needs, is to educate trustees, committeemen, teachers and even many physicians in physiology and hygiene.

Prof. J. Madison Watson, of Elizabeth, was then introduced, and opened the discussion on this paper. He thought it was well at the opening of this discussion to recognize the fact that practically man is an integral, that his powers of mind and body are indivisible, that he is a very oneness. Education really embraces the drawing forth of all the faculties—the discipline of the intellect, the establishment of the principles, the regulation of the heart, of the manners and outward conduct, the training and symmetrical development of both mind and body. Physical restraint in the school-room is an abnormal condition, and it should be exceptional. The healthful activity of the mind involves neither physical restraint nor mere acquiescence, for both mind and body are naturally accordant. The apt teacher readily awakens interest and enthusiasm in the minds of his curious and inquisitive pupils. He secures fixed attention for brief periods, and so varies the lessons that the very changes are recreative. He employs extensively blackboard exercises and the numerous pieces of apparatus and appliances of the modern school-room, so that the relaxation involving idleness and mischief is quite unnecessary. Our physical organs should become a part of our education. We should be under perfect control, that every movement may be properly directed and controlled. Prof. Watson described several physical exercises, including phonetics. He spoke of the great variety of movements of the body which might be practiced where there were no mechanical appliances. He recommended them as invaluable to secure the development of bodily vigor. He was inclined to doubt whether there could be a well developed mind without a proper physical development, or whether there could even be a true moral character without a well developed body.

Dr. E. M. Hunt said the term "physical restraint" in connection with our schools seemed to sound out of place, as we are accustomed

to use it in reference to our asylums and prisons. He preferred the word "discipline" or training as thus applied. He spoke of the necessity of simplifying physical culture or exercise, and spoke warmly in favor of it.

Rev. F. R. Brace, Superintendent of Schools of Camden County, said he was in harmony with the views presented as to the propriety and necessity of proper physical development. No one was more earnest in advocating physical training in the school-room, but he said that he also believed in physical restraint. He spoke of the world on which we live as being kept in its place by the law of restraint, which is one of the great laws of the universe; of liberty of movement as always within the restraint imposed by law; of the train of cars having its liberty only as long as it is restrained within the limits imposed by its parallel rails; of restraint as necessary to strength; manhood is in its fullness only when great reserve forces or restrained forces are preserved. He spoke of the general that wins the battle as being the one who knows how to put restraint on part of his army, who can keep back on the side of some hill or in some woods a corps of men who may be eager to be in the midst of the fray, but who are held there by his iron will until the proper hour arrives, when he gives the word and these men pour in upon the battle-field and the victory is won. He believed restraint is necessary to development, is necessary to permanent success. He was compelled to differ with one of the gentlemen discussing these papers, who said that he doubted whether there could be a proper mental or moral development without a proper physical development. Mr. Brace believed the *mens sana in corpore sano* was a very valuable maxim. That a good sound, strong body is necessary for this world's work; but he called attention to many persons physically diseased, almost if not quite from their birth, who nevertheless had made the grandest mental attainments, and many such who have attained to the most beautiful, most lofty moral character. He felt that while we should give due attention to this important side of human training, we should not exalt it beyond its proper place.

MORNING SESSION.

SATURDAY, November 20th.

The Association reconvened at 9:45 o'clock A. M., President Green in the chair. The resolution introduced by Mr. Harrison was reported back favorably and adopted, and Dr. D. L. Wallace, of Newark; E. G. Harrison, C.E., of Key East; Dr. H. Mitchell, of Asbury Park; J. B. Pudney, Esq., of Passaic, and Dr. E. M. Hunt, of Trenton, were appointed said committee.

THE WORK OF THE PLUMBER.

Mr. J. J. Powers, of Brooklyn, then read an interesting article on "The Work of the Plumber and the Modes of Conveying and Disposing of Sewage." (See this report, page 75.) He spoke of the great progress made in plumbing since his connection with the plumbing trade began some 20 years ago. Formerly, he said, the plumber's work was considered successfully accomplished when the water freely ran from the supply pipes and the waste waters were quickly carried off through the discharge channels. Afterwards, when diseases increased in number, the medical practitioners revealed the fact that some connection existed between these diseases and defects in the plumber's work; this was the first step towards improvement, and to physicians alone are the public indebted for the advance in experimentation and investigation. Next came the evolution of the sewer-gas theory, which forced upon the plumbers many microbes and sanitary engineers to be taken care of in some manner least prejudicial to the public health. * * * The improvements in plumbing within the last ten years are simply phenomenal.

Dr. E. M. Hunt, in opening the discussion on Mr. Powers' paper, said that he should occupy the time asking Mr. Powers questions rather than in commenting on the paper. The chief questions and answers were as follows:

Q. What relation has the height of a waste-pipe to the siphoning of traps? *A*. As I have the waste-pipes always extend up through the roof full bore and open there, and as I use the bottle trap, I disregard height.

Q. Has the length below the trap any influence on siphonage? *A*. Yes; but with the bottle trap I do not take it into account, as the siphon action is valuable to stir up and dislodge sediment that would otherwise remain in the trap.

Q. Should a trap be of smaller calibre than the pipe? *A*. It should never be smaller and may be larger, but I have never found it unwise to have it the same size.

Q. Do you, as a plumber, know of many cases of pressure of sewer-gas in pipes? *A*. I, in my experience, have never known of a pressure from the sewers great enough to disturb any reliable trap, except where there was an obstruction.

Q. Should each trap have a vent-pipe at its crown, or out-go? *A*. If the main-pipe opens on the roof, and the horizontal branch is not more than 7 feet from the main, and such a trap as this bottle trap is used, I think it unnecessary.

Q. In your judgment, should there be a trap on the soil-pipe as it leaves the house to pass to the cesspool or sewer? *A*. Yes.

Q. And in that case should there be a vent-pipe inside of this trap running up the outside of the house? *A*. There should be, or some form of opening to the air. There is, I know, more circulation of air in the house-pipes or more currents when the vent is not carried up, but terminates at the ground level.

Q. What should be its calibre? *A*. It is best to have it nearly that of the vertical soil-pipe.

Q. Can lead and iron pipe, as bought by the pound, be trusted to have uniformity of thickness? *A*. Yes, generally, but much is used that is too thin throughout.

Q. What should be the thickness and quality? *A*. Extra heavy iron and D lead waste.

Q. Should the iron pipe be coated as in the Angus Smith method? *A*. I do not believe it should, as it conceals defects.

Q. What plumbing regulations do you most approve? *A*. Those of the Brooklyn Board of Health.

Prof. F. A. Wilber, of New Brunswick, asked Mr. Powers if he had ever used alum in place of perchloride of iron and chlorine for precipitation. He replied that he had not. He had used unslaked lime, but the odor was objectionable. He had never used the sulphate, but the perchloride of iron had given him the best satisfaction.

Prof. Wilber said that alum is the best coagulant he knew of, bet-

ter than the perchloride, very much cheaper, and can be had anywhere. Sewage thus treated may be safely put anywhere. He also spoke of the value of sewage thus treated for agricultural purposes.

PRESERVED FOODS.

Shippen Wallace, Ph.D., of Burlington, was introduced, and presented a paper on "Preserved Foods." After tracing the early history of the preservation of foods, he spoke of its introduction on a commercial basis in this country during the California gold excitement, in 1848, but not to any extent until the civil war commenced, since which time it has steadily grown until now it has assumed enormous proportions, and preserved, or as more commonly called, canned articles of food are to be found in all parts of the world, and mainly of American production. He spoke of the vast number of articles now preserved, and we can well remark, as did the poet over two hundred years ago:

> "There's no want of meat, sir,
> Portly and curious viands are prepared
> To please all kinds of appetite."

Millions of dollars of capital are now invested, mostly in the Middle and Eastern States. It has been estimated that there are over 800 factories in the United States engaged in this work, turning out 500,000,000 tins annually. For several years there have been an average of 50,000,000 cans of salmon packed; tomatoes, 72,000,000 cans; corn, 5,000,000. Besides these we have the various other vegetables, meats, condensed milk, fruits, &c., &c. The process of preparing consists in partially cooking and then hermetically sealing the article in a tin or glass vessel, and when properly done it will keep for an indefinite time. At the Fisheries Exposition, in Berlin, in 1880, the American canned salmon, which was awarded the first prize, was packed in 1875. Dr. Wallace then refers to the remarkable freedom from adulteration of these canned goods, while there has been so much adulteration of other articles during the past decade. He cited a number of instances of the chemical examination of large varieties of canned goods. It has been the universal verdict of those who have examined them that they contain nothing injurious or harmful. He made the assertion that there is not on record a well-

authenticated case of poisoning or death from the use of canned food that was sound at the time it was consumed. Death recently resulted in a case where the victim had eaten putrid salmon. It is such cases as these which have created the impression in the public mind that some legislation is necessary for the protection of the public health, when it is safe to say that far more sickness has been occasioned by the same amount of fruits, vegetable, fish and meats not canned. A moment's reflection will show that food exposed to a high degree of heat, as all canned goods are, in the preserving process, are more likely to be free from disease-producing germs, and as canned goods are usually put up at the sources of supply while fresh, and are hermetically sealed while in that condition, they are really fresher and more wholesome than the so-called "fresh" fruits, &c., which are exposed for considerable periods of time in city markets. In opening a can, if it has been improperly sealed, one may find the contents extremely acid or covered with "mold;" if so do not use them. All preserved foods should be removed from the cans when opened, and portions not allowed to remain in for several days, as the action of the air causes the acids, &c., to act on the metal of the can, and after a few days sufficient of the tin may be dissolved to cause sickness, or the food may be spoiled. In concluding, he advised no one to buy what are called "swells" in the trade—where the top or bottom of the can is swelled or pushed out by the gas in the interior. This bulging shows imperfect process of canning, which causes some fermentive change in the contents. Reprocessed goods should also be avoided—a small hole is punched in the end of the can, the contents then reboiled, the swelled head pushed down and the new head soldered up. A new label is then put on, so that the can will look as good as new. They may sometimes be identified by finding two soldered holes instead of one in the top or bottom. All articles found in cans rusted or corroded should not be eaten. Remember that all canned goods, especially meats, *should be removed from the can immediately on opening* and then placed in glass or earthenware vessels and treated the same as ordinary articles of food, that is, placed where they will not putrefy or ferment.

Prof. F. A. Wilber opened the discussion on Dr. Wallace's paper. He thought that little need be said after the full presentation of the subject in the paper. After commenting on some points of the paper, he said that one other point was worthy of consideration—the cleanli-

ness of the surroundings where these canned goods are put up. They should be inspected as in some of the meat-packing establishments. "The large plant he had visited was so unclean in its surroundings that he had never since bought any vegetables that were put up at that plant."

Dr. [illegible] of Allentown, agreed with Prof. Wiley. He had made similar observations in visiting some canning factories. He had known of cases of lead-poisoning from carelessness in sealing cans.

Dr. [illegible] of Jersey City thought that not only these factories but our bakeries and confectionery establishments should also be investigated in this point of cleanliness of surroundings, and also as to purity of materials used.

[illegible] President of the Society for Prevention of Adulteration of Foods and Medicines, [illegible] said we had not only the matter of adulterations but also of sophistications in canned goods to fight.

Dr. [illegible] thought the meat alkaloids are one of the new phases of this subject which needs to be investigated.

DRINKING-WATER AND TYPHOID FEVER.

The President announced the next paper on "The Relation between Drinking-Water and Typhoid Fever." See paper in this volume, page [illegible].

Dr. [illegible] of New Brunswick was then introduced and opened the discussion. He said the history of [illegible] disease [illegible] the view that many diseases have their origin and development in specific [illegible] germs. These [illegible]

latter part of the last century. Have not our microscopes shown that the virus was in the shape of a germ? To this class of diseases typhoid fever belongs. It can be transmitted by a saturated atmosphere (through sewer-gas), also by diseased meat, but above all, and embracing all, by drinking-water. This may arise by a concentration in wells during dry seasons as instanced by Dr. Lindsley; by water contaminated in the laundry, and the refuse finding its way to the water supply; from wells polluted by escape from vaults; by pollution of streams; by milk, according to Ballard, where the cans were washed by polluted water. Dr. Baldwin cited numerous illustrations to enforce these statements.

Prof. J. H. Raymond, M.D., of Brooklyn, N. Y., thought possibly too much attention had lately been given to the causation of typhoid by drinking-water. He does not believe that water is the only carrier of the poison by any means. In Brooklyn they had abolished nearly all the public pumps, only one now left, but typhoid fever did not disappear. Last year there were 150 deaths. In nearly all the epidemic, where the cause had been traced to drinking-water, the number of cases was large, what we should expect. The converse should be equally true, where a small number of cases, the causation by well or drinking-water is disproved. Drinking-water had comparatively little to do with causation in these 150 cases. They had a complete history of every case from October 1st, to the end of the year 1885. No single cases did we find where perfect plumbing was found, but in all cases it was found faulty. The sewers were disinfected and the epidemic ceased. He believed that three things were essential in preventing epidemics of this disease:

First. See that the plumbing is in good condition.

Second. See that the discharges of typhoid fever patients are disinfected.

Third. See that the public sewers are disinfected.

Dr. E. M. Hunt said he would present two thoughts: *First.* If typhoid fever is generally conveyed by water, it is scarcely safe to assume that it is never conveyed by air in close proximity to water. He instanced a case in his practice where he had reason to believe that it was contracted from the vapor arising from soiled typhoid clothing which was being stirred while being soaked and heated over a fire. The water of moist air can get into the lungs and the stomach. In the close rooms of the sick, the water of very moist and warm air is

a probable source of communication as well as drinking water. *Second.* The fact that a disease is shown to have a specific organism or microphyte does not prove that it may not have arisen without a previous case of the same *exact specificity.* There can be such newness without involving the acceptance of any doctrine of spontaneous generation on the one hand, or without denying on the other that such diseases arise in the great *majority of cases* from an antecedent case. Dr. Hunt illustrated this by showing how hybrids are multiplied so distinct from their parentage as to have a type of their own. On the authority of Prof. Grey and others, he contradicted the common impression that hybrids are sterile, as they are sometimes immensely prolific. He brought this new view to bear on what may be called the infinitessimal botany of communicable diseases. He claimed that by what we may have at times to call fortuitous circumstances, new forms of disease may spring up from peculiar approximations of the low plant life of diseases, and by peculiar conditions of atmosphere and surroundings. Thus out of the jungle fever of Africa, and the "bilge and hold" typhus of the tropics, may have come yellow fever; out of common intestinal fluxes and aggregated and vicious cross and culture power on the delta of the Ganges, cholera; out of minglings of microphytic life in animal and vegetable decompositions, typhoid fever; and from excessive conditions, the ordinary forms of sore throat occasionally have given place to diphtheria. In the mind of the speaker, this was not a mere idea, but seemed a necessary hypothesis derived from studies and experience in epidemiology. The most hopeful ideas in sanitary and medicinal therapeutics are: (*a*) to find whether and under what circumstances hybridism or other *de novo* production of contagium occurs; (*b*) to find and overcome those insanitary conditions of surroundings favorable to the reception or propagation of disease; and (*c*) by antiseptics to sterilize the human system in times of exposure, so that it will refuse reception or culture to this destructive plant life.

Dr. I. N. Quimby thought the paper an able one. He agreed with Dr. Hunt. He believed that cases of diphtheria and typhoid fever were met with of spontaneous origin.

AFTERNOON SESSION.

SANITARY ADMINISTRATION.

The concluding session was held at 2:15 o'clock P. M., when the President introduced Prof. Jos. H. Raymond, M.D., of Brooklyn, who delivered an able lecture on "The Chief Points in Sanitary Administration; What Should be Required as to Vital Returns and the Notification of Disease." He did not believe that the sanitary administration is efficient when the power is vested in a Board composed of a number of members. A single individual invested with administrative power is far better. There are so many cases where prompt action is required, and it does not do to wait for the meetings of the Board, which is usually held at stated intervals. The head of the department should have a competent deputy to represent him when ill or necessarily absent for some other cause, who should be clothed with powers equal to those of his superior. There should also be some one on the staff whose duty it should be to take charge of the vital statistics. He should be one who is familiar with the nomenclature of disease, and a person of experience. He should be thoroughly informed as to localities where disease prevails or epidemics are likely to break out. There should also be on the staff of a regular organized Board of Health a number of medical men specially educated in the diagnosis of contagious diseases. A typical Health Board was, in the speaker's opinion, one composed of men who devote their entire time to sanitary affairs. Persons who have their living to make will of necessity always subordinate public to private duty. He was persuaded that one man giving his entire time was worth more than five men giving only a part of their time. Each one of these medical Inspectors should be assigned a district, and it should be a permanent appointment so that he could become thoroughly conversant with the people's sanitary surroundings in their homes, and so come to be looked upon by the people in it as their health officer. Such an officer can gain the consent of persons for the removal of patients, when removal is necessary, better than a stranger can. All the subordinates in a health department should be, in a sense, experts. The Inspectors should possess a knowledge of human nature, with tact—knowing how to deal with men. In a word, they should possess common sense.

Many an Inspector has failed for want of it. Every Board of Health should have a chemist, to determine questions of adulteration of milk, of foods. There should be one or more public vaccinators; this appointment should be permanent; each one should go over the ground of his district not only during epidemics of small-pox, but also between the intervals. The tendency is too much to treat small-pox after it comes, rather than to prevent its appearance. A veterinarian is also important as an adjunct to an efficient Health Board. Some diseases of the lower animals are communicable to men. It is very important for the protection of the community that meat be inspected regularly, and it should be inspected at the slaughter houses where the viscera as well as the carcass can be well examined. He had known of many cases where such examination (of the viscera), where the meat had been condemned, in which, if the carcass only had been examined, the meat would have been sold. In our cities and towns where it is impossible to dispose of waste material on the spot, and we have to have sewers, there should be one or more efficient plumbers on the Health Board. It not only makes the ordinary plumber more careful when he knows that his work is to be inspected, but he has known of many cases where defects in the soil-pipes in the wall had been detected by a competent plumber, when the ordinary physician without practical experience in plumbing had failed to detect them.

The Health Department he thought should also embrace a fumigating and disinfecting corps, it may be a medical corps, perhaps one or more specially skilled laymen. He spoke against the popular fallacy that a little sulphur burned in a hot pan, or in fact any fumigation that can be done while the patient is in the room is sufficiently effective. In regard to the returns of physicians and others he thought a great deal of the difficulty is chargeable at our own doors. If their reports are only placed on file without further investigation, the physicians are not likely to take much interest in it. We should treat all contagious diseases alike. Physicians report small-pox cases because they know that Boards of Health take cognizance of such cases and institute steps at once, and because the general public believe it to be the most terrible of diseases, and physicians are liable to be denounced for failing to send in reports to the authorities. Why not in diphtheria, typhoid fever, scarlatina and measles? Some ten years ago the Brooklyn Board treated all these disease alike. Educational documents on the importance of stamping out these dis-

eases were sent out among the people and they did an immense amount of good. Some physicians look upon the requirement to report as illegal and as an invasion of their rights, but they are growing less and less in number.

In Brooklyn the cases of contagious disease are reported to the Inspector of the district in which they occur. When received the Inspector goes to the house and inspects the surrounding, endeavors to ascertain its origin, &c. The children in the family are prevented from attending public schools, if necessary the Inspector notifies the teachers. When deaths occur in contagious disease cases the Inspector should be sent to the house, should see that it is properly disinfected, allow no public funerals and see in every way that its spread shall be prevented. The importance of physicians making returns of these cases will be seen when it is understood that they are the basis of efficient work by the Health Board.

Dr. D. L. Wallace, of Newark, opened the discussion on Prof. Raymond's lecture. He thought the plan detailed was admirable in cities and large towns. In Newark they had eight physicians who attend the sick and poor, and they report monthly. They have eight Sanitary Inspectors who report every day as to the condition of their respective districts; they are trained by lectures, &c. Every city should have one or more Sanitary Engineers to do this drilling or training, and they should examine the sewers and drains and the plumbing. He would insist that disinfection and isolation should be enforced in contagious diseases. The law allows physicians 25 cents for each contagious case reported. He thought that returns of births, deaths and marriages should be made direct to the Board of Health.

The President announced the following Committee on Legislation: E. S. Atwater, Esq., of Elizabeth, Chairman; L. B. Ward, C.E., of Jersey City; E. M. Hunt, M.D., of Trenton; Hon. E. O. Chapman, of Trenton; and J. A. McGrath, Esq., of Jersey City.

The Secretary reported from the Executive Council the following nominations for officers for the ensuing year:

President	W. K. NEWTON, M.D.	Paterson.
First Vice-President	E. L. B. GODFREY, M.D.	Camden.
Second Vice-President	H. MITCHELL, M.D.	Asbury Park.
Recording Secretary	D. C. ENGLISH, M.D.	New Brunswick.
Corresponding Secretary	Prof. J. MADISON WATSON	Elizabeth.
Treasurer	J. C. PUMPELLY, Esq	Morristown.

EXECUTIVE COUNCIL.

(With the above-named officers.)

DOWLING BENJAMIN, M.D., *Chairman.*	Camden.
MERRILL E. GATES, LL.D.	New Brunswick.
Hon. E. O. CHAPMAN	Trenton.
Rev. Dr. A. E. BALLARD	Ocean Grove.
G. P. OLCOTT, C.E.	Orange.
C. B. BRUSH, C.E.	Hoboken.
Rev. F. R. BRACE	Blackwoodtown.
Prof. CHAS. JACOBUS	New Brunswick.
C. P. BASSETT, C.E.	Newark.
Hon. J. A. McGRATH	Jersey City.
SHIPPEN WALLACE, Ph.D.	Burlington.
Prof. WRIGHT ECKERSLY	Long Branch.
S. H. HUNT, M.D.	Long Branch.
D. L. WALLACE, M.D.	Newark.
URIAH WHITE, Esq.	Asbury Park.

These gentlemen were unanimously elected.

FOODS, DRINKS AND ILLUMINANTS.

Dr. Newton then read a paper on "What Boards of Health Can Do to Prevent Adulteration of Foods and Drinks and the Sale of Dangerous Illuminants."

He said it was not his intention to deliver an elaborate lecture, as the programme would indicate, but he thought that the purpose of the State Board in asking him to address the Association would be accomplished if he ran over in a conversational way the various branches of the topic. He said that the question propounded by the title might be answered by saying that the powers conferred by law on our local Boards of Health were so supreme, that if they enforced the laws the sale of adulterated foods and dangerous oils would be immediately checked. He also stated that no new legislation was needed under this head, but that sufficient power was already given, and that all that was necessary was for Boards to begin work. He discussed the topic under the following heads: I. Powers of local Boards, (*a*) under the food law, (*b*) under the milk law, (*c*) under the dairy protection act. II. Powers to prevent the pollution of water-supply. III. Powers regarding the sale of illuminating oils. IV. Duties of Boards.

An act to prevent the adulteration of food or drugs, passed in

March, 1881, and the supplement of 1883, defines and prohibits adulteration and empowers local and other health officers to enforce it. The milk law also empowers local Boards to check the sale of impure milk. Under the dairy protection act of 1886 the sale of impure butter may be prohibited. Local Boards also have power to forbid the sale of oil that does not come up to the legal test. Regulations for the government of Inspectors under these laws have been issued by the State Board of Health, and clearly define the duties of these officers. In closing, Dr. Newton said that in all cities and populous towns and boroughs the local health authorities should enforce these laws, and that Inspectors should be prepared to insure a pure food supply. He recommended, when possible, a chemist should be in the employ of local Boards to whom could be sent foods and drinks for analysis. In the smaller towns and villages, where the expenditure for these purposes could not be warranted, that the State Board should have supervision over this kind of work, and that samples of foods and water should be sent to that body. He stated that the State Dairy Commissioner would examine samples of milk and butter without expense to the local Boards of Health. Dr. Newton illustrated his lecture by exhibiting various instruments for testing milk, oil, &c. A sample of milk that had been procured in Trenton was examined and found to be above the average in purity and richness.

J. C. Pumpelly, Esq., moved the following, which was unanimously adopted:

"*Resolved,* That the State Board of Health be requested to call the attention of township and other authorities to the law that makes the establishment of a Board of Health mandatory."

Dr. Mitchell claimed that we should do our best to secure better administration of sanitary laws. The work of training Inspectors can and ought to have immediate consideration. The State Board of Health is now taking steps towards their more thorough culture in sanitary science. One of the most pressing needs to-day was a law, properly enforced, to secure the proper construction of houses, especially of their drains.

Dr. F. Gauntt, of Burlington, desired to express his gratification, and congratulate the Association on the great progress made in our State in sanitary matters, and gave this Association great commendation for what it had accomplished.

President Green, in a few closing remarks, spoke of the growth of the Association in influence and earnestness, and he felt that this meeting had been a remarkably successful one.

Thus closed the twelfth annual meeting, which, in the presentation of able papers and lectures, and the interesting and practical discussions thereon; in the desire for and determination to do more thorough work through better administrative methods and more thoroughly qualified health officers, as well as in the enthusiasm exhibited in behalf of sanitary reform in its various departments, will, it is believed, exert an influence throughout the State, which will be powerfully felt during the coming years.

SUMMARY OF REPORTS FROM LOCAL BOARDS OF HEALTH.

BY THE SECRETARY.

Besides the frequent correspondence had with the various local Boards of Health throughout the State, the law requires an annual report, as follows:

SEC. 11. *And be it enacted*, That every local Board of Health of any township, county, city, borough, town or other municipality shall, on or before the first day of October in each year, in addition to other reports required, prepare an annual report of the condition of the public health in their several districts, stating therein any special cause for deterioration of health or of hazard thereto, and shall therein answer any inquiries which may have been addressed to them by the State Board of Health, and such Boards shall forward a copy of such reports to the State Board of Health on or before the fifteenth day of October in each year.

In accordance with this section of the law, full response is made by the most of the Boards. Where there is no report it is usually because of want of proper organization of the Board. Here and there a township regards itself so remarkably healthy, or some member of the township committee is so positive as to the needlessness of a Board, that the law is not conformed to. Yet just such townships are now and then caught with the intrusion of some nuisance that might easily have been prevented, or with the outbreak of an epidemic, which only gets headway because the local Board is not in working order. Just now two townships are involved in an epidemic and a panic that could never have occurred in other townships where the Boards are in ready understanding as to authority and how to use it. As a consequence, the expense of a month and the loss of trade to the district will be more than Health Boards would have cost in ten years.

The following is the usual schedule which is sent each year to the local Boards:

SCHEDULE OF SUBJECTS FOR REPORT.

A. Location, population and climate.
B. Geology, topography and contour.
C. Water-supply.
D. Drainage and sewerage.
E. Streets and public grounds.
F. Houses and their tenancy.
G. Modes of lighting.
H. Refuse and excreta (how managed).
I. Markets.
J. Diseases of animals.
K. Slaughter-houses and abattoirs.
L. Manufactories and trades.
M. Schools and school and other public buildings.
N. Almshouse, hospitals and other charities.
O. Police and prisons.
P. Fire guards or escapes.
Q. Cemeteries and burial.
R. Public health laws and regulations.
S. Registration and vital statistics.
T. Quarantine or care over *contagious* diseases and vaccination.
U. Sanitary expenses.
V. Heat and ventilation for dwellings.
W. Prevalent diseases of the year.

Other subjects may be named under X, Y, Z. The subjects may thus be referred to by the letters.

If the sheet provided is not sufficient, add others, marked with the letters which designate the topic treated.

Where there have been previous reports, some of the items are already on file and do not require repetition.

Where there is evidence of neglect or of the need of more active measures, we now seek to send Sanitary Inspectors to instruct local Boards in the law and their duties under it; to aid local Inspectors and to, in other ways, supplement the work of the local Boards. The State Board has resolved to give the services of its Inspectors more fully to the local Boards where there is evident need of it. Here and there a city which neglects its sanitary care, and so becomes a menace to the State at large as well as to its own citizens, will be visited, inspected and fully reported upon by the State Board or its representatives.

The returns from local Boards, many of which are valuable as records, do not need to be repeated in the annual report. We therefore study brevity, and only abstract so much as seems to be of general interest. Other Boards are thus often guided in their duties and privileges.

ATLANTIC COUNTY.

ATLANTIC CITY. - *Report from* M. D. YOUNGMAN, M.D., *Sec'y.*

The water-supply has been ample for the past year, and of most excellent quality. The company deserve commendation for their care in filtering and storing in time of plenty for the drouth that usually attends the summer season along this sea-coast. Many people still depend on cisterns, but the majority use the city water. The fact of its source being from a stream arising from numerous local springs and traversing a country that is almost wild, gives a feeling of confidence in its purity. All lead pipes have been removed by order of the Board and replaced with galvanized iron.

The drainage system in operation here is still undergoing improvement, although so far as fulfilling the ends sought as to removal of sewerage its success is demonstrated. The large increase of hotels and cottages connecting necessitated the addition of another suction pump and this was added the first of the year, and during the busy season both were kept running. At the request of the Board the company agreed to put flush tanks at the extremes of the system and build manholes at the intersection of all streets. The company have found it advisable to remove many of the terra cotta pipes first put down, and replace them with larger iron ones, particularly in those streets where they approach the pumping station and needing to be put at the great depth necessary to get the requisite fall. An increasing number of people connected with the system this fall, and all express themselves pleased with its operation. In those cases where no sewer connection is made the Board observes the strictest oversight to see that the ordinance requiring brick cesspools with water-tight bottoms is complied with.

Our streets, always noted for their uniformity, and finely paved, have been kept unusually clean the past summer by direct supervision of the Board. All the surface-water is carried off through a system of trunks that empty in the thoroughfare on the lea of the Island, and no surface-water is allowed to enter the sewers.

Within the last year the incandescent electric light has been introduced in our city, and is being very generally adopted by the hotels. This, one of the most important sanitary improvements of the age, is of particular value here where large numbers of invalids congregate

through the winter and spring months. Gas is of good quality and used still in many public and private buildings.

Contents of cesspools and privy vaults, as well as garbage, is transported in sealed dunigans on scows to points on the mainland 25 and 30 miles distant from the city and composted.

There are several large charitable institutions here, among them a home for children, where hundreds of lives are saved every summer of children from the lower classes of the large cities. Besides the main building there are a series of small cottages for a mother and her children. All of these institutions are in first-class sanitary condition. The Mercer Memorial House for Invalid Women is the last institution opened, and is fitted up with every convenience and sanitary improvement.

All our larger hotels are well provided with fire-escapes.

No cemeteries or burial grounds on the Island.

Some comment was made last year concerning the death returns from the city, and in consequence a record was kept showing the proportion between resident and non-resident deaths. There are registered for the year 209 deaths; of these 102 were residents of the city and 107 were non-resident visitors. Atlantic City being a popular resort for invalids, particularly those suffering with chronic diseases, the death-rate is necessarily larger. In the summer large numbers of babies, suffering with the illnesses prevalent in the cities among children in the heated term, come here, some of them moribund when they arrive. Then, too, many of the deaths occur in the various institutions; and, secondly, many of the permanent residents have impaired lives. People who on account of chest, rheumatic, nervous, or other troubles, live here permanently because of the relief the climate affords them.

These regular "house-to-house" inspections are made each year by the Inspector of the Board, and all cases of disregard or non-compliance with the requirements of the Board are dealt with immediately. Besides the Sanitary Inspector, the city has an Inspector of vessels entering the port here.

Council pays all bills contracted by the Board from an appropriation made in accordance with an itemized list furnished by the Board of Health.

Most large hotels are heated by steam-heat, direct and indirect radiation; many smaller ones and cottages by hot-air furnaces and

stoves. Good ventilation is sought after. Indeed, so assiduously are "modern improvements" and "sanitary appliances" sought after and introduced that foundation is afforded for fearing that in some instances the object in view is defeated.

There has been no epidemic disease of any kind during the year past. We are constantly exposed to contagious disease and have every year perhaps one or two cases of one or the other of them—brought here by patients suffering with them in the cities.

EGG HARBOR CITY. - *Report from* F. NORMAN, *Secretary.*

Water-supply is mainly derived from wells. Driven wells are greatly in favor, and furnish an excellent water. There is a good natural drainage throughout the city, but the water level was very high this year and water came into many cellars.

The general health of the city is good. Contagious diseases have not occurred. One complaint of a nuisance at a slaughter-house has been made, and, upon notice sent to the owner, abated. A permit for location of a private burial place, within the city limits, has been asked for, but not granted by the Board.

EGG HARBOR TOWNSHIP. - *Report from* ISAAC ANDREWS.

The reports of previous years having rendered answers to the questions in relation to location, population, water-supply, etc., we would pass to the state of public health, the condition of which, during the last year, has been exceptionally good. Whilst it gives an occasion for profound gratitude in a sanitary point of view, it leaves us but little to report concerning medicine. Owing to the cool summer months there have been no intestinal diseases among children, nor any diseases incident to heat and drought. A mild form of pertussis in and around Pleasantville constitutes all there has been of an epidemic character.

The Board has exercised vigilance in reference to the proper rendering of vital statistics.

Our sanitary expenses have been confined to the necessary expenses of the local Board and the prosecution of a case, in order to abate a nuisance.

GALLOWAY TOWNSHIP. - - *Report from* E. A. HIGBEE.

The water is all received from wells dug in the earth at various depths, owing to location. The water from the same is pure and healthy.

Houses are well built as far as convenience for health is concerned, and are occupied by one family only, except in a very few cases. Not over one-half dozen, I think, in the whole township, has more than one family in them.

No disease among any animals excepting hogs; but among them there is a disease known as hog cholera, which has prevailed throughout the township and nearly all die that have it.

There has been no prevalent disease among any persons in the township this year.

HAMILTON TOWNSHIP. - *Report from* D. B. INGERSOLL, M.D.

The water-supply is chiefly, almost entirely, from wells, and is generally good. Some, in the large villages, situated on the Great Egg Harbor river, obtain their supply from that stream. This water, according to the report of Prof. Geo. H. Cook, to whom a specimen was submitted for examination, "*is remarkably pure and soft, and nothing better for household purposes.*" There are two artesian wells in the township, the one at Mays Landing, the other at Weymouth, from which a number of the families of each place is supplied. These two wells are supplied from the same stream. The water contains a trace only of *iron* and *sulphur*; thus the supply of *good* water is abundant. There are a few instances, however, which form the exception to this rule. In some tenement houses the wells are not properly kept in repair, consequently they are the general receptacle for toads and poisonous matters, which subject these families to disease. No house should be rentable unless it contains the general sanitary requisites, particularly a supply of good water.

There is no regular system of drainage or sewerage employed in the township. Many families adopt thorough plans for that purpose suited to their individual cases. Others adopt none. I have succeeded in many cases in convincing them of the necessity of this and in remedying the evil, yet there is much still to do. Cellars are usually dry. But little malaria.

The houses have but in a few instances basement cellars, and these not occupied. At times vegetables are stored therein.

The excreta is disposed of in the usual way among farmers. Some cesspools are cemented with bottom, and cleansed frequently, others have open bottoms, and cleansed once or twice a year. The contents carted by the farmers and composted on their farms.

We have had no general diseases during the year. Even the diseases incident to the season have been slight. Our assessor is a faithful officer, and does *all* his duties well.

We have no slaughter-houses in the township.

We have in the township a large cotton factory and also a large paper mill. In the former about five hundred hands are employed, and some three hundred in the latter. In both of these factories as much sanitary care as possibly can be is taken. I have had occasion to speak with the superintendent of the cotton mill in regard to some sanitary matters, and he has always given me cheerful attention, and at once acted on my suggestions.

The schools in our township are in a good condition. Two are marked "*first class*" by the County Superintendent, and the other two as "*good*." The houses are well heated with coal and properly ventilated. This being the county seat, the jail and court house is situated here. The jail is of stone, with the jailer's residence in front, of wood. There are *ten cells* in the jail, five on each side, situated the one on top of the other. These cells are small, and in the summer are overcrowded. The ventilation and sewerage are good. The jail is kept in as good a condition as circumstances will permit. The court house and other public buildings are in the same condition as at my last report.

The sanitary expenses are met from the "incidental fund" of the township.

There have been no prevailing diseases during the year. Not a single case of diphtheria or typhoid fever. During the latter part of winter and during the spring months, we had a number of cases of pneumonia and other lung troubles. Inflammatory rheumatism, erysipelas and other acute diseases have been quite prevalent. And what is somewhat singular, the old chronic cases have been much aggravated.

While there is much still to do by our local Board of Health, we feel that we have accomplished much in this direction. We have a code, somewhat severe in some particulars, yet in no instance have we been compelled to enforce it. It is readily obeyed by the people as

soon as they can see its necessity. Education in this direction is much better than force, is our experience. And if the attention of the public could be drawn to this matter more generally, by circulars from the State Board of Health, distributed judiciously to many of the families, or by the press, or in any way that we may reach them, we think it would result in much good.

BERGEN COUNTY.

HARRINGTON TOWNSHIP. *Report from* FREDERICK MORRIS, M.D.

There is no system of public water-supply.

There is no system of drainage or sewerage. There are small drains on private properties, and a limited attempt to drain the low lands on some farms has been made. But there is a real need of opening and straightening the brooks flowing into the Hackensack through the swamps of Norwood and Closter. Those swamps would then become useful lands, and the unwholesome fogs and mists at present such a drawback to the healthfulness and growth of the above-named places would disappear.

The roads throughout the township, except in the immediate neighborhood of Closter, seem to undergo no improvement.

The sink or cesspool is generally in use. It would seem that the system of dry-earth closet has never been sufficiently brought to the notice of the public.

Sifted coal-ashes, dry earth of any kind, that swept from the road or dug from the yard or garden, being so easily procured.

Perfect deodorization and perfect security from feculent contamination of wells, although only a part of the advantages being inestimable of themselves, should be sufficient to recommend the earth-closet to general use.

A box to hold the dry material, a scoop to lift it and a receiving box under the seat, removable from the rear or side, is an arrangement much more economical than the loathsome and hideous privy-vault almost universal in the rural districts.

HACKENSACK. - - - *Report from* A. S. BURDETT, M.D.

The water is excellent. It is obtained from the Hackensack river above tide-water and navigation, and pumped into a reservoir at an

elevation of 110 feet above the town, and hence supplies the same by the force of gravity.

The drainage and sewerage are good. The sewers, as far as completed, are the best in quality, and in construction are equal to any in the State.

Refuse, garbage, etc., are removed by scavengers; and excreta, etc., by an odorless excavator.

One slaughter-house located within the town limits.

School-buildings, with respect to construction and ventilation, are excellent.

The present Board of Health, organized last May under the new State law, has passed several ordinances. The Board has become popular in the town and is doing good service.

PALISADES TOWNSHIP. - *Report from* J. M. SIMPSON, M.D.

The health of this township during the past year has been very good indeed, and, according to the reports of the resident physicians, above the average. Diseases of a malarial type have been on the decrease for the last three or four years, and this year have been less than usual. There has only been an epidemic of mumps and whooping-cough, but no fatal cases of either disease.

There has only been two complaints made to this Board, and in both cases the causes of the complaints were quickly abated when the attention of the proper parties was called to them.

RIDGEWOOD TOWNSHIP. - *Report from* THOMAS TERHUNE, *Sec'y.*

We have but little to report. The general health has been good. No prevalent disease has existed. We have no slaughter-houses. There has been no contagious diseases among horses or other animals during the year. There is a good natural drainage throughout the whole township.

UNION TOWNSHIP. - *Report from* GEORGE H. CORMACK, *Sec'y.*

Water-supply is from wells and cisterns, which is generally good.

There is no public drainage.

The laws of the Township Board of Health are the laws that govern all such bodies.

We have had very little malaria during the past year, and no contagious diseases.

BURLINGTON COUNTY.

BEVERLY CITY. - *Report from* A. W. TAYLOR, M.D., *Secretary.*

Located on the Delaware river, about fifteen miles from Philadelphia. Has a population of about 2,500, which is somewhat increased during the summer by transient residents. The climate is such as other places along the Delaware from Philadelphia to Trenton, the winters being a little cooler than those of the opposite Pennsylvania shore and the summers also cooler from the fact of the cool, westerly winds traversing a mile of space over the river; as the Pennsylvania shores opposite Beverly are high and free from swampy lands, the prevailing winds (which come from that direction) come to us free from marsh poison; and our own soil being high and dry, we are blessed with a greater exemption from malarial troubles than many places along river courses.

The surface has a level appearance, but in fact there is a fall of about thirty feet from the railroad or southern city line to the river or northerly boundary, and this in about half a mile, thus giving a good opportunity for drainage, either natural surface or by a system of sewerage.

Our water-supply is at present entirely from wells, but water-works are in process of erection, and by January 1st, 1887, we expect an abundant supply from the Delaware, which will be distributed from a stand-pipe or forced directly by the engines, if so needed, in case of fire.

Drainage is entirely of the surface, and so far no trouble has arisen from it except in isolated cases of gross carelessness. The introduction of water-works will probably force a system of sewerage upon us, as the present lack of method will be inadequate to the removal of an increased amount of water.

It would be possible to make the streets worse than they are, but it is by no means necessary or probable that they ever will be. The drive-way is worse than any of or than most of the county roads

about us, and unpaved gutters make some portions of the streets a series of rapids with every summer shower. There are no public grounds; there should be a plot of ground reserved along the river as a public square as a means of public health as well as pleasure.

Our houses are mostly frame; a large portion of them owned by their tenants, and as a rule the grounds are neatly and healthfully kept.

The kitchen refuse is collected by neighboring farmers or by our own citizens living on the outskirts of the city. No hogs are, according to city law, allowed in the built-up portions, and the law is, with a few exceptions, respected. The privy refuse is collected by a colored citizen, and so composted on the extreme edge of the city as not to be either offensive to the eye or nostril.

We have no slaughter-houses in the city limits; no large animals are killed in our vicinity; all of our beef is purchased by the local butchers in Philadelphia.

There is but one manufactory in our town and that is of stockings and jackets.

One public school, a branch of the State Normal (the Farnum Preparatory), and two small private schools. The sanitary condition of each is, in the main, good.

One constable and one marshal. The only place of confinement is a series of six cells in the basement of the town hall; a place unfit to keep a prisoner in, in cold weather, having but little or nothing in the way of bedding, but a place in which the confinement is a mere matter of volition to a man of strength or ingenuity.

No fire guards or escapes upon any of the public or private buildings. Two fire companies have just been organized.

One small and rarely-used cemetery.

Public health laws and regulations are few, and up to the present time the scattered condition of the tenements has seemed to render few necessary, but the time is near at hand when a closer building up of the town will render more stringent laws and a positive enforcement of them necessary. Generally such laws as exist are respected, and any transgression of them is quickly remedied upon proper notice. Each year the Board of Health make a more or less general inspection from house to house, and notice being given of such a visit ten days or more beforehand everything is found in good condition.

Registration and vital statistics are complied with, as a rule, as far as the marriage, birth and death certificates of the State require.

As a general thing, we have very little trouble from contagious disease, and for several years there have been no epidemics, only isolated cases of such form of disease. There is no established system of quarantine and no pest-house or place to which cases of contagious disease could be transferred. For three or four years past there has been no compulsory vaccination; about that time all the school children that had not been were vaccinated.

There has been an inclination to reduce expenses for sanitary purposes to a low figure; in fact, there has been but little need of much expense, as the most of the sanitary changes and improvements have been such as were chargeable to and were met by private individuals. There has been a difference in views as to the financial rights of the Board of Health between the Board and the city council.

The Board believes that it has a right to a five-cent per capita appropriation from the city funds, which it shall possess to use as needed, but for the use of which it must report strictly and accurately to the city council.

The council seem to feel that they are to furnish the funds to pay the necessary expenses incurred by the Board, but that the Board is not to have the handling of the funds. At present it makes but little difference perhaps either way, but there is an opportunity here for a clashing in the future. Will not some one give us the correct status of the local Board in this matter?*

The year has been a healthful one; no epidemics have visited us. During July and August we had the usual amount of bowel troubles, which unfortunately were magnified immensely by a reporter of one of the Philadelphia dailies into a terrible epidemic. There were no more than the usual number of such cases and there was no epidemic. There were some severe cases of dysentery, but the majority of these yielded to treatment and were in almost every case traceable to errors of diet, exposure to excessive heat or some local sanitary defect. There has been less than usual of the fall fevers; no cases of smallpox; not more than half a dozen cases of scarlet fever, and but few cases of the minor contagious and infectious diseases of childhood. We have very few cases of consumption; in fact, it is a disease from which we have a remarkable exemption among our permanent resi-

*The Camden city council procured the opinion of its solicitor, Mr. Morgan, and also the written opinion of G. D. W. Vroom, and upon it directed the council to pay over the entire per capita to the Board of Health.—SECRETARY.

dents, although persons afflicted therewith very often spend weeks or months with us and finally die here as they would anywhere else.

The pressing need of Beverly in the near future is a system of sewerage. The increased facilities which a supply of water (such as a public system of water-works affords) gives to servants and housekeepers for waste water and saturating the soil must soon efface the virtue of the soil as a filter and saturate it with vegetable and animal refuse in the shape of finely-divided waste from the kitchen. In many cases, too, the water-closet and bath-tub will, from the nature of the case, be emptied into a vault, generally very primitive in its construction and too close to the well of drinking-water. Such being the case, a system of sewerage becomes a measure of self-preservation. A poor substitute, for a time, for a sewerage system would be paved gutters, carefully graded, which would lead off all liquid refuse to the river.

CINNAMINSON TOWNSHIP. *Report from* ALEX. MARCY, Jr., *Sec'y.*

Nothing special to report, excepting history of a few cases of diphtheria, which is enclosed.

No epidemics, scarcely any malarial trouble, and not the usual amount of sickness. Death-rate low and birth-rate increased. A few cases of diphtheria, whose history was exceedingly interesting, and somewhat puzzling.

A young boy, six years of age, was taken suddenly ill on the —— day of July. He had been in fair health before this. Some time ago had had an attack of ulcerative tonsilitis, and the mode of invasion, symptoms and appearances of this attack seemed very like that. He was, however, immediately quarantined, and rigidly kept away from other members of the family. In twenty-four hours the throat had undergone a complete transformation, and we had developed an unmistakable and typical case of diphtheria of an adynamic type. The case was jealously guarded, all sanitary precautions were taken, and the boy came through safely, after an illness lasting three weeks. Suffered to a slight extent from paralysis.

Ten days after the entire disappearance of the false membrane, he was given an antiseptic bath, wrapped in a perfectly clean blanket, that had not been near the sick room, and taken into a different part of the house. The sick-room was immediately closed and thoroughly disinfected by burning roll sulphur. The bedding was put in a strong

solution of hydy. bichlor., taken out and boiled, old things were burned—in fact everything destroyed that could possibly contain any of the poison. After two weeks he was allowed to go round cautiously, and in a week more was taken to Cape May. He was kept there two weeks, came home and remained a week, and then was taken to the mountains, and remained eight days.

Soon after leaving the mountains, a young lad of twelve was taken with what was supposed to have been diphtheritic quinsy, but which was true diphtheria no doubt, as it was followed by paralysis.

Did this child that had been rid of the disease for from six to seven weeks originate the trouble? But stranger still, this child, three weeks after coming home, infected his two brothers, that slept in the same room with him. The strange features of these cases are:

1. The origin of the first case. The child had not been away from home; there had not been a case of the disease in the neighborhood for years.

The child was surrounded by all the comforts and safeguards that intelligence or wealth could suggest.*

Living in a new house, where every attention had been paid to the sanitary arrangements—in fact a very model of perfection—a large house, with open fire-places in every room as well as in the halls, with Waring's system of drainage and plumbing thoroughly and practically introduced.

With no possible source of contamination of the drinking-water, and which water, by analysis, proved to be unusually pure and wholesome.

A long time before, the boy had suffered from ulcerative tonsilitis, and the beginning of this attack seemed to have the same mode of origin, and closely resembled that disease.

Could there have been something in the boy's condition which caused the simple ulcerative process to be changed into a specific inflammatory condition, with the evolution of the true diphtheritic poison?

Or is the difference between ulcerative tonsilitis, or "diphtheritic

* While this is thoroughly true, an examination of the grease-pot and of the closed cesspool in the yard showed such defects as to leave no doubt that the kitchen sink to which the children were exposed was a constant source of active, decomposing organic matter.—SECRETARY.

sore throat" as it is often called, and diphtheria one of degree rather than of kind?

2. Is it possible for the poison of the disease to remain about a person for eight or ten weeks after full convalescence has been reached?

If so, when are you safe in letting a person who has had this disease mingle with those who have not?

Such a history as this inclines one to the belief that diphtheria does not always arise from a specific poison, and that it is possible for a person to have the genuine disease without having been brought in contact with the poison from a preceding case, and that, too, when the person is surrounded by the most favorable hygienic conditions. Also as to time of isolation and quarantine, certainly not a less period than three months will suffice, and even four months would be better in the question of when the child might be permitted to attend school.

FLORENCE TOWNSHIP. - - - *Report from* DR. BAKER.

It is situated on the eastern banks of the Delaware; population, 978. Climate temperate.

Sandy loam, with clay bottom. It extends along the river about three miles, and about two and one-half miles back.

The houses are mostly frame, with cellars. Are largely used for storage for vegetables. One family in a house. There is no Inspector.

Diseases of this place are mostly of malarial fever.

NEW HANOVER TOWNSHIP. - *Report from* GEORGE C. DAVIS.

No contagious diseases, and the health of the township has been generally good the past year. Diseases among animals have been quite prevalent, especially among the young swine. In a herd of my own, taken with the disease, I commenced using the different powders advertised for the cure of diseases in swine, with little or no advantage. I finally adopted, with marked results, a remedy of my own of sulphur, Spanish brown and salts. It seemed to cure when all other remedies failed. The way I administered the above is as follows: Five tablespoonfuls, very large, of sulphur and Spanish brown

each, and one pound of salts to a barrel of swill, twice a day. There has been an epidemic among turkeys worse than the chicken cholera.

I have noticed one thing this year as regards malaria in our township. The inhabitants for a number of years have been from time to time suffering with it throughout the entire township, but especially along creeks and ponds, the cause of it being the water getting very low, thereby becoming stagnant and polluting the air, and so breeding disease in the form of malaria. One pond I noticed in particular for a number of years. There is a farm situated by the side of it. There was a family moved there about five years ago; the water in it became very low, turning a greenish color in summer. One of the family was taken down with malarial fever, and then another, until it went through the whole family. Three years later there was another family moved on the same farm, and they all passed through the same ordeal. This last summer the creeks and ponds were swollen to their utmost capacity, and the consequence has been no malaria in the township the past summer. Therefore it is proven that stagnated water breeds disease. This should awaken in the people an interest for having good drainage throughout the country to give them health and length of life, to improve the appearance of their farms, as well as the pecuniary advantage that would be derived therefrom. There are acres of swampy land which hold stagnant waters in dry seasons of the year, which, by a little expense, would pay largely for the labor expended on them, and the owners would be highly gratified by the improvement of the sanitary condition of the neighborhood. I know some instances where there are small cesspools running up almost to the very doors of dwelling houses. I think when people are awakened to the fact of their own danger, and that of the public in general, there will be more interest manifested in drainage.

NORTHAMPTON TOWNSHIP. *Report from* CHAS. E. TRAVIS, *Sec'y.*

The water-supply is furnished by a private incorporation to about one-third of the dwellings and is cedar-swamp water, pronounced by the physicians very healthy. It is dark in color and soft. The balance is supplied by wells, is hard and considered good. The reservoirs and pipes are cleaned from once to twice a year.

All the houses have cellars; they are generally dry and used for storing household supplies.

There are several slaughter-houses. They are kept passably clean, no complaint having been made to us by neighbors to them.

There has been a new school-house built. Its sanitary condition is first-class, is well-lighted and ventilated; considered the best in the county.

The prevalent diseases for the past year have been intermittent fevers and other forms of malarial trouble. There have also been some few cases of diphtheria and typhoid fever.

There has been quite a number of complaints received by the Board, and in all cases they have been attended to immediately and satisfactorily to all parties, excepting one complaint as to a pig-pen, which the Board is making some provisions for.

CAMDEN COUNTY.

CAMDEN. - - *Report from* SEPTIMUS KNIGHT, *Inspector*.

Reservoir supplied from the Delaware river, above the city. Supplied by the city. The first six wards are mostly supplied from this source. The Seventh ward has about two-thirds of its supply from the city water works, the balance from wells. The Eighth ward mostly supplied from wells.

As a general thing the drainage is good, the outlet being the Delaware river and Cooper's creek. Much could be done by this city to better the drainage by having all streets guttered with stone. In numerous places where there is no stone gutter, quagmires are formed which cause the foulest odors to be exhaled. There are in different parts of the city vacant lots which, from their location and surroundings, are at times covered with stagnant water, producing complaint and disease; but the Board of Health are using all the means in their power to correct this condition by filling up.

Refuse which is cleaned from the streets is deposited in designated places within the city limits. The streets are cleaned at intervals, but the large surface of cobble-stone pavement, irregular and uneven in many places, should receive more frequent attention than is given, for the securing of health and comfort; in fact, all the streets and gutters should be attended to oftener than is the custom, especially in the summer months. Excreta is removed from the city in tight box wagons, or by air-tight barrels, when required, by individuals or by order of the health officer, upon complaint.

Slaughter-houses are generally kept in good condition, and all drain into the sewer. A great many of them have arrangements for rendering out fats collected from time to time which, in most cases, has been complained of as a nuisance to the Board of Health, and they have now under consideration the best way to get rid either of the bad smell or the fat-rendering part of the establishments.

DELAWARE TOWNSHIP. - *Report from* JOSEPH G. EVANS.

No artificial system of drainage or sewerage is employed. One hundred and sixty-seven acres is tide marsh, near Camden.

There are few tenants. The houses are mostly frame, with a few brick and stone structures. Cellars are the rule. There is no inspection without complaint being made.

Refuse is either destroyed by fire or scattered over the land. Human excreta is confined to boxes or shallow wells, permitting frequent removal for conversion into compost or manure. No deep wells are known to the committee.

GLOUCESTER CITY. - - *Report from* J. A. WAMSLEY, M.D.

The city schools are heated by stoves and are well lighted. The water-supply is from driven wells, and mostly surface-water is obtained for drinking purposes; although a good distance from cesspools, this should be remedied and the water taken from the city water-supply. The drainage and sewage of the city schools are in a fair condition.

There are three burial grounds used within the city limits but are a safe distance from the built-up portion of the town. Two of the cemeteries are well taken care of by the keepers; the graves are five or six feet deep and are considered sufficient.

The disposal of house refuse is not governed here by any special legislation or ordinance, and often this refuse and garbage is deposited on vacant lots, alley-ways and sometimes in the street, and some decided, definite action should at once be made by city council.

Now we arrive at a subject most important to Gloucester City. The topography of this city is favorable, in general, to good drainage if proper means were employed to effect it, but, unfortunately, little effort has been made yet to effect better drainage and sewage; but three short culverts have yet been built in the town. Almost all of the cesspools are simply sunk in the ground and are not cleaned more

than once a year, and others not in years until complaint is made and the owners are obliged to comply.

A Board of Health ordinance, a very important matter of legislation here for the city council to act upon, should at once engage the attention of all—to form a Board of Health directly under the State law. The laws and regulations of the present Board are very deficient and have outlived their usefulness, even if they were ever of any value.

Gloucester City has been remarkably free from epidemic diseases for the past year, excepting the prevalence of diseases incident to childhood, as pertussis and measles.

HADDON TOWNSHIP. - - *Report from* DR. F. E. WILLIAMS.

Haddonfield's water-supply is still as it has been in the past, from wells, though by the first of the coming year a water company will supply the town with a service of water remarkably free from organic matter. At present there is but little in the town but what is contaminated to a more or less degree by cesspools, &c. In some parts of the township the water is slightly impregnated with marl.

The drainage and sewage is very poor, but this Board has compelled the cementing of cesspools as rapidly as possible.

Refuse and excreta of the town have been the subject of much care to the Board, who have ordered the former to be carted away from the town at once, and the latter to be confined in cemented cesspools.

There is a slaughter-house upon the outskirts of the town, but the owner has taken proper precautions so no trouble exists.

There are five public school buildings in the township, and the various Boards have used every precaution to insure good sanitary conditions, both as to ventilation and privies.

A year ago the Board, finding so many nuisances of great importance existing, enacted several ordinances upon the various necessary subjects, and has rigidly enforced them. At first they were but partially understood, as were the legal powers of the Board, but they now have the support of nearly every one.

REPORT OF INSPECTOR AND TOWNSHIP PHYSICIAN.

The last twelve months, from October 1st, 1885, to October 1st, 1886, have been remarkably healthy ones, there having been no local epidemics of any kind, and but few cases of contagious diseases.

There has been reported to the Board of Health, in compliance

with an ordinance adopted last year, twenty-one cases of diphtheria and diphtheritic sore throat, and two cases of scarlet fever. In only one instance were the ravages of diphtheria marked, and that in a poorly-kept tenement house in the rural portion of the township, where four deaths occurred out of five persons affected with the disease.

There have been thirty-six inspections of properties made by the Inspector, the nuisances to the public health consisting of pig-pens, cesspools, privy-vaults, street gutters, manure piles and dead animals. These complaints were at every meeting reported to the Board, and the decisions of that body were speedily attended to by the property owners, and in no instance was trouble given nor unnecessary delay indulged in.

There has been a decrease of diseases of malarial origin during the past year. Most of the cases that have appeared have been decidedly of the remittent type, there seldom being any marked chill, fever and sweat, but an increased pyrexia at certain regular periods, and a less marked fever all through the intervals, mild congestion of the brain, with severe cephalgia and vertigo being almost always present during the acme of the disease. These remittent fevers showed a decided tendency to run into a typhoid condition, and these typhoid-remittents have been more numerous than heretofore. Haddonfield always has been, and is now especially, exempt from the true typhoid fever.

Bad sanitary arrangements, particularly in regard to the improper storage of the refuse of the kitchen, will in time contaminate the (at present) good well water, as it has already done in several wells in the town; it is therefore with delight that we hail the prospect in the near future of obtaining an ample supply of pure spring water, delivered through the town by a stock water company at a reasonable rate.

This plentiful supply of water may become a curse to the inhabitants if some means of getting rid of the waste is not obtained, for it will overflow the surrounding grounds of each house so supplied, or the gutters in the adjoining streets with filthy and soon to be stagnant water.

A general and complete sewerage system through the whole town is the only preventative, for which the location of Haddonfield is admirably adapted, being situated in a rolling country, with every natural facility for drainage into a large stream flowing direct to the Delaware.

BOROUGH OF MERCHANTVILLE. *Report from* WM. H. MOSES, *Sec'y.*

The water-supply is wholly from wells or cisterns, although in about a month a public supply of the finest spring water will be introduced to all desirous of using it.

The general health of the borough has been good and no epidemic of contagious disease has occurred.

CAPE MAY COUNTY.

CAPE MAY CITY. *Report from* HENRY A. KENNEDY, M.D., *Sec'y.*

The water-supply of Cape May City has been increased during the past year by the building of new works by the city, consisting of a series of 6-inch tubular wells, 50 feet apart, connected to a powerful steam pump, by which the water is forced either directly through the mains or into an elevated tank for distribution, as occasion may require. The water is remarkably pure and soft, free from color, taste or odor. The site of the works is on a farm, one mile north of the city limits, beyond all danger of contamination.

The Board appointed a sanitary or health Inspector, for the months of June, July, August and September, to inspect all nuisances complained of and make weekly inspections of all hotel premises and the city in general, with power to abate, or cause to be abated, all nuisances found.

There were thirty-five nuisances abated during the "season," mostly caused by depositing garbage and filth in back yards and out-of-the-way places.

All cesspools are required to be cleaned at night, by first obtaining a permit from the Board.

There are no slaughter-houses in the city, and no swine are permitted to be kept within the city limits during the summer months.

There has been no epidemic or prevalent diseases during the past year, with the exception of a few cases of whooping-cough. The health of our city has been above the general average.

DENNIS TOWNSHIP. - - *Report from* MORRIS WARWICK.

Contagious diseases are treated by township physicians with the greatest care to prevent spreading; persons affected are usually kept aloof from their neighbors.

No particular disease has been more prevalent than another. One case of small-pox; got well.

HOLLY BEACH CITY. - *Report from* WILLIAM PAUL, *Sec'y.*

Public health good. Five cases of typhoid fever; no deaths. No laws or regulations.

LOWER TOWNSHIP. - *Report from* WM. C. RUTHERFORD, *Sec'y.*

Swine disease is pretty bad, but not so bad as last season. It is supposed that about half the number died, compared with last year. The disease is called hog cholera.

Public health laws and regulations are looked into by our local Board, and at any meeting requiring our consideration we refer to the State laws and instructions of Secretary of State Board of Health.

Registration and vital statistics are sent to the Secretary of the Board of Health for this township monthly by the assessor.

There have been no prevalent diseases this year among our inhabitants. It has been considered by all that it has been an unusually healthy year. The hog disease has not been so bad as last year, although some of the farmers have lost all their hogs. It has been mostly confined to the vicinity of Cold Spring. As the season advances it begins to subside.

MIDDLE TOWNSHIP. - *Report from* STILLWELL H. TOWNSEND.

The water-supply is mostly from dug wells, although quite a number of people use water from tubular wells. The water from them has generally the taste of iron.

Cellars are generally dry except in extreme wet weather. There has been but very little malarial fever the past year.

Houses do not generally have cellars, although there are quite a number in the township. They are mostly used for the storage of vegetables. About eight houses are occupied by two families.

OCEAN CITY. - - *Report from* J. S. WAGGONER, M.D.

The water-supply is from cisterns, with a few exceptions. Not more than two families are supplied from one cistern. It being rain-water, is scarcely ever discolored, and only for a short time, when

caught from new wooden roofs. There are some two or three families that depend on wells for water.

The only system of drainage we have is by gutters on sides of streets, which gives us ample drainage, there being plenty of fall. There are no cellars, except on the highest ground; the number does not exceed six. Malaria is unknown here.

Cesspools, as built here, are cemented on sides and bottoms. The contents are removed by dipping out into barrels for the purpose and removed a safe distance from city and covered or composted.

We have had no prevailing diseases; in fact, we were almost entirely exempt from diseases of any kind except occasionally a little derangement of the bowels, which yielded promptly to mild treatment. No seaside resort on the New Jersey coast, I can safely say, for the healthfulness of the place, can rival us, making it a desirable place for the pleasure-seeker, and especially the invalid.

SEA ISLE CITY. - - *Report from* GEO. W. URQUHART, M.D.

All refuse and excreta is removed twice a week, during the summer months, from the island, in tight wagons. No excreta is allowed to enter the ground; boxes or receptacles are raised 6 inches above the surface, therefore, allowing free circulation of air, also inspection.

CUMBERLAND COUNTY.

CITY OF BRIDGETON. - *Report from* CHARLES E. SHEPPARD.

During last year the city has, in general, been in a healthy condition, with no prevalent diseases.

Nearly all the cases that come before the Board are minor cases, being principally filthy privies and out-houses, with some complaints against pig-pens and slaughter-houses.

During the last two or three years the Board has secured the removal of all slaughter-houses, except one, beyond the built-up portions of the city.

DEERFIELD TOWNSHIP. - *Report from* DR. CHAS. C. PHILLIPS.

During the past year no epidemic of any kind whatever has visited us. We have had but few cases of disease of either a bilious or

typhoid nature. Our township is situated in the northern portion of Cumberland county, and being about the most elevated of any in the southern portion of the State, with excellent surface drainage, no stagnant water whatever in the township, malarial diseases have not much sway amongst us.

Our water-supply comes principally from wells through the medium of the bucket and windlass or the wooden pump, and the water is of an excellent quality.

The refuse and excreta is generally carted as manure onto the land, and being plowed under and mixed with the soil, loses its deleterious effects and becomes a fertilizing agent in agriculture.

I do not think that this township is second to any in the point of health, and it will also compare favorably with any other both as regards cleanliness on the part of its inhabitants and a regard by them of all sanitary regulations.

HOPEWELL TOWNSHIP. - *Report from* CHARLES H. DARE, M.D.

The past summer has been remarkable for its healthfulness, very few cases of bowel affections among children and none fatal, as far as I am aware. During the past winter there were a number of cases of diphtheria, some proving fatal from œdema of the glottis.

The hog cholera that prevailed to such an alarming extent during 1884–5, is now extinct; I do not think there has been a new case in the township for a year past. There have been no complaints entered to the Board during the past year of nuisances; vaccination is not looked after by the Board of Health.

LANDIS TOWNSHIP. - - *Report from* THEO. FOOTE, M.D.

In a large part of the dwelling-houses outside of the borough the cellar is used for the storage of vegetables. No yearly house-to-house inspection.

The slaughter-houses have been inspected several times during the year, and the keeping of hogs to eat the offal, etc., has again been prohibited. How to dispose of the offal, etc., so as not to be a nuisance to the neighborhood, has received the attention of the Board. Arrangements have been made with some of our farmers to take the

blood and offal and use them for fertilizers. All the slaughter-houses have complied with the request of the Board and removed the wells at least 50 feet from the buildings, so that they have now good water for the animals, etc.

The Board has given attention to the out-buildings and wells connected with the public schools. The wells, in several instances, have been cleaned, cemented and pumps put in. With open wells we have found that in some way pieces of clothing, sticks, dead rats, mice, etc., get in, and we have recommended that all school wells be cemented at least 3 feet from the top, and, also, that the well be so enclosed as to prevent the throwing into it of any article. The Board's preference is to put in a pump.

The borough of Vineland has a Board of Health separate and distinct from the township Board.

MILLVILLE. - - - - *Report from* L. H. HOGATE.

There are excellent water-works in the city, owned by a private corporation, but for the most part the citizens depend upon wells for the water-supply, and a very excellent quality of water prevails.

We have no system of drainage or sewerage; all of it is surface drainage. The subject of sewers is being agitated to some extent.

Cesspools are cleaned at night and during hours prescribed in ordinances of the city. Garbage and refuse of all kinds are removed far into the outskirts of the city.

All our school-houses are well lighted, but the ventilation might be greatly improved. Most of the buildings (eleven in number) have been built for a number of years, and it is hoped with all new buildings better attention will be given this important matter.

There have been no prevalent diseases during the year.

MILLVILLE TWP. - *Report from* THEODORE C. WHEATON, *Sec'y.*

The supply of water comes from surface wells and water-works owned by a private company; the water coming from Wood's pond, which is the Maurice river dammed at Millville, the head streams of which come principally from cedar and spruce swamps. The water is said to be very pure. It often has slight reddish or swamp-water color but no

peculiar or offensive taste. It is used more or less by about half the houses, many only using it for sprinkling purposes. The well-water is excellent, and is principally used for household purposes, although the hydrant is growing more and more into favor. The pond-water contains very little sediment, and the stand-pipe, which is about ten feet in diameter and one hundred and twenty-eight feet high, was cleaned after standing five years, when only one-and-a-half bushels of sediment was found in it. The delivery is through a perfect circulating system of pipes, which does not admit of any stagnant water. There are blow-outs, however, which are occasionally used to cleanse the pipes. No sewage of any kind empties into the river above the point of supply. There is no cistern-water used.

We have nothing but surface drainage, but we think the day is not far distant when a system of sewage will become necessary. Our cellars are dry. We have a few small swamps near us, but scarcely any malaria for past three years.

The houses about all have cellars but are scarcely ever occupied. We have very few tenement-houses of more than two families. There is no yearly house-to-house inspection. We have scarcely any cesspools; there is an occasional barrel sunk into the ground with both heads out.

There has been no disease prevalent this year, although we have had some scarlatina, measles and whooping-cough. Very little typhoid or malarial fevers. The writer had two cases in one family (father and son) clearly traceable to fecal emanations. They worked in a portion of the bleachery, in a room by themselves, located adjoining the privy, which is used by a number of hands in the place, and at times the fecal smell was very offensive, there being holes in the floor of their room immediately over the fecal accumulations. They worked together here for months and were finally taken down about one week apart with a violent type of typhoid fever. The father was a great deal better on the twenty-first day, but relapsed and the fever ran on to the forty-second day. He finally made a good recovery. The boy had fever thirty-two days and was delirious most of the time. He also made a good recovery. Their residence is a new house, with good water, cellar dry and everything kept nice and clean and privy at least one hundred feet from house well. The father, when first taken, said all he could taste or smell was like his room where he worked, which shows a complete saturation with the poison.

BOROUGH OF VINELAND. - - *Report from* DR. BIDWELL.

In Vineland, our Board of Health, recognizing the dangers of the ordinary village privy and of privy-vaults, adopted, in 1883, the system of tubs or buckets, to be frequently emptied, with the removal of the contents entirely from within the borough limits.

Although water-works have since been introduced, a considerable portion of our inhabitants continue to depend upon their individual wells, and the system of privy-buckets is still enforced. Indeed, the present Board of Health, and, it is believed, a majority of our citizens also, are now so well convinced of its value as a sanitary measure that it would be retained irrespective of any necessity of protecting the water-supply.

A brief account of the practical working of this system here and the difficulties encountered in efficiently carrying it out may be of service to other Boards.

Our present ordinances require simply that the receptacles under the privy-seat shall be water-tight, of sufficient size and number to accommodate the deposits for at least one week, but not too large to be conveniently handled; that they shall be elevated not less than six inches above the ground surface, and be protected from roof and storm water, and that they shall be kept always in good repair and in proper position.

It was at first required that every deposit should at once be covered with fine, dry earth, sifted coal ashes or similar absorbent. This, certainly the ideal method, is still strongly recommended by the Board and is considerably employed. But it was found, as might perhaps have been expected, impossible to enforce this provision uniformly. The lower classes could not be induced to take so much pains, and many of the more intelligent and law-abiding merely made a show of doing so.

Our ordinances were persistently advertised, but many failed, for one reason and another, to provide their privies with receptacles.

Then the Board sent individual notices to the delinquents, in some instances many times repeated, but with only a moderate degree of success.

Finally, after it was thought that "moral suasion" had been thoroughly tried, we appealed to the law to help convince the obstinate ones. Several well-to-do offenders were successfully prosecuted, under the act relating to Boards of Health, before a justice of the peace. The

uniform result was a fine of ten dollars, with costs of suit, imposed upon the defendant.

One case was appealed to the court of quarter sessions, where Judge Reed affirmed the judgment in our favor. This case caused the Board much trouble and considerable expense, but it was worth all it cost, for since that time an intimation from the Board of Health has had more practical and immediate effect than could be produced before by the most impressive warning we could devise.

People were convinced by these prosecutions that the Board of Health had power to enforce their ordinances, and that fighting them was a losing and expensive game; and as by the constant agitation public opinion has been pretty well educated up to the point of sustaining the Board in this matter, there is now very little trouble in enforcing the privy ordinances, and legal measures will probably not soon be again required.

The most satisfactory receptacle, in our experience, is a hard-wood tub or bucket, tarred inside and out. They are more durable and less expensive than metallic pails. We buy at the groceries empty butter-tubs (oaken ones only, for those of soft wood soon fall to pieces,) and have a blacksmith put on an iron hoop and coat them with gas-tar. Such a tub will last several years if protected from the sun. The Board furnishes them, to those who wish, for fifty cents, which price allows us a profit of a few cents upon each.

Our scavengers like them as well without handles, so we save their expense.

These tubs are set upon a shelf under the privy-seat so as to be directly under it and close up against it.

For a time the privies were kept clean without expense, either direct or collectively, the borough being divided into districts, and a farmer agreeing to remove the contents of the buckets as often as required in the district assigned to him by the Board in return for the exclusive right to the privy-manure of that district.

This plan, however, worked very poorly, and with a great deal of friction.

It would seem at first thought that the privy-material would be so valuable a manure as to amply repay the cost of collection and transportation.

But it is not so under the bucket-system. There is so little at each privy that it takes considerable time to collect a load, and the buckets

being water-tight all the liquid has to be transported as well as the solid matter. Where it is deposited directly upon the ground, or into leaky vaults, the less valuable urine soaks away into the earth, leaving only the more valuable and more easily handled fecal matter for the scavenger to carry away.

The experience of our farmers, also, seems to indicate that the manurial value of privy-deposits is not so high as is generally supposed. At any rate, they seem pretty generally agreed that it costs more to collect it than it is worth to them.

They could afford to collect it in the winter when horses and men are idle, but in the spring and summer, when the work most needs doing thoroughly then there is most to be done at home.

Another trouble was to get faithful drivers for the carts. Reliable men who would do such work for the wages the farmer could afford to pay are scarce.

Then again it was found that some who for years had been content to make their deposits upon the ground and leave them there more or less exposed to the weather, and within a few feet of their well, developed, after the introduction of the new system, a great anxiety to have their privies kept scrupulously clean.

This class, with the proverbial zeal of recent converts, made frequent and often unnecessary complaints of the neglect of the scavenger.

He, as his work was in a measure gratuitous, on his side felt sensitive to ill-deserved blame, and the Board found it well-nigh impossible to so act the mediator as to prevent ill-feeling, even if it could secure reasonably efficient work.

It had long been considered by the Board that eventually the work must be paid for by contract, that the contractor might be held to strict accountability for the performance of his duties.

Buckets allowed to run over frequently are greater nuisances than the old vaults and "dug-outs" they replaced, and it was very evident that something must be done to secure proper attention to them or the system was doomed to failure.

Finally, when two of the scavengers resigned and their places could not be filled, the borough council was induced to appropriate a sufficient sum, and to make contracts by which the contractor binds himself to empty every privy at least once a week, and oftener if necessary to prevent running over.

Payment is made every three months, and the contractor's bills

must be approved by the Board of Health, so that in case the work is slighted, though not to such an extent as to render the contract void and subject the contractor to the forfeiture of the "liquidated damages" provided, a part of the money may be withheld.

Under these contracts we have succeeded in getting the privies pretty well attended to, and the cost to the tax-payers is at present less than fifty cents a privy *per annum*.

Some people were at first addicted to throwing coal ashes, tomato cans, broken glass, and like refuse into the privy-buckets as the readiest way of disposing of them. This of course was very objectionable to the farmer who used the material for manure, so it was prohibited by ordinance.

Now, when the scavenger finds any considerable quantity of foreign matter in the buckets, he refuses to empty them, notifies the Board, and the Board sends a copy of the ordinance to the offender with a notification that his privy must be cleaned at once at his own expense.

Another ordinance provides that no discharge from a person suffering from any contagious disease shall be put into the privy-buckets, but shall be either destroyed by fire, or disinfected and buried as remote as possible from a well or dwelling-house.

In case of the prevalence of any serious epidemic, say of typhoid fever or of cholera, the Board would probably order the disinfection at frequent intervals of the contents of all privy-buckets.

It is believed that it can be done much more efficiently in them than in any vault, however well constructed. Where privy-deposits are suffered to fall directly upon the ground, thorough disinfection would, of course, be found very difficult if not impossible.

ESSEX COUNTY.

BLOOMFIELD. - - - *Report from* WM. H. WHITE, M.D.

The principal complaints during the year have been about cesspools and privies, and in all cases the inhabitants, when notified, have abated the nuisance at once.

IRVINGTON. - - - - *Report from* JOS. L. WADE, M.D.

The usual water-level secures dry cellars. Not any swamps in our vicinity of any extent. Near South Orange township line there is

swampy ground, drained by a ditch running through our incorporated district, opening into the Elizabeth river; another below the Newark city line, drained by sewers located in Newark.

We are free from malarial disturbances.

Cesspools, stone sides laid loosely, cemented in some cases, open bottom; emptied by excavators or by hand-dippers; carried away in closed barrels, between the hours of 8 P. M. and 4 A. M. Contents utilized by gardeners and truck farmers in vicinity. Open cesspools are more in vogue, easily cleansed and less danger.

MILLBURN TOWNSHIP. - *Report from* ISAIAH WILLIAMS, *Sec'y.*

The local Board has this year been very effective, and designated me to attend to nuisances during the hot weather. I abated a number of cases—hog pens, privies and dead animals—firmly establishing the authority of the Board at the cost of $3 to a constable, which was charged to township expenses.

NEWARK. - *Report from* DR. DAVID L. WALLACE, *Secretary.*

The population at this date is estimated at 159,018.

No provisions have been made as to a new water-supply. Since my last report a Board of Pollution has been established, made up of certain members of the Newark Aqueduct Board and the Jersey City Board of Public Works. They have appointed an Inspector and furnished him with a launch to patrol the Passaic, between Newark and Paterson, to ascertain all points of pollution with a view to having them removed.

Since the 1st of October, 1885, there have been 7.86 miles of brick sewers and 6.18 miles of pipe sewers laid, making at this time a total of 52.86 miles of brick and 15.18 miles of pipe sewers established in this city. The intercepting sewer that I spoke of as in process of building last October is not as yet completed. It will be in working order by January 1st, 1887, and there is every reason to believe that it will accomplish all that is claimed for it.

Since last report pavement has been laid in a number of streets. On Broad street, from William to Lincoln Park, the old cobbles have been replaced with oblong granite blocks. A distance of about three miles is provided with this pavement.

Since last October 8,508 houses have been inspected, with the find-

ing of 1,202 nuisances; of these 1,076 have been abated. In addition to this 845 cases of defective plumbing and drainage have been rectified.

At the present time an ordinance is before the Board requiring that all privy-vaults and cesspools shall be water-tight, and that on streets in which a sewer is laid they shall not exist. This will in all probability be passed after which one of the greatest evils I have had to contend with will be under control.

Since my last report, as you are well aware, by a decision of the Supreme Court, the Newark Board of Health was declared not to be a Board working under the general health laws of the State, and it was obliged to fall back on the city ordinance of 1884 to maintain an existence. As soon as the new law passed by the last Legislature went into effect, we took advantage of it and reorganized under its provisions. Since that time we have had to do over again all that was undone by the decision of the court, but we are now in good working order, with the mass of our citizens giving us their cordial support. We have not as yet passed many ordinances, but the first to be passed was the ordinance regulating the emptying of vaults and cesspools, which was the cause of our overthrow. The other ordinances passed are those giving us power to quarantine animals when found necessary; prohibiting the storing and keeping of old rags, bones, &c.; regulating the sale of meats, fruit and vegetables, and ordering condemnations when found necessary. An ordinance regulating contagious and infectious diseases has passed its second reading, and will be read on its final passage in November.

SUMMARY OF ALL WORK DONE FOR THE YEAR.

Number of notices served for abatement of nuisances	2,688
Abatements	2,297
Number of notices served for rectifying defective plumbing and drainage	1,120
Number of cases rectified	962
Number of sewer permits granted	944
Number of permits granted for cleaning privy-vaults	2,582
" " " " " cesspools	656
Analyses of milk	34
Persons found unvaccinated	3,393

If we add the number of unvaccinated persons reported this year to those of last year, we will have a total to date of 4,618. The

names of all these persons, with their residences, are on record in the office of the Board. At our meeting of this month I suggested that the names and addresses be given to the eight district physicians, with instructions that they call at their homes and offer them free vaccination. The members of the Board were favorably impressed with the suggestion, and I think at the next meeting this will be ordered.

The work of milk inspection is being prosecuted with vigor, and at the present time the quality of this article is very good.

The Veterinary, Meat and Food Inspectors are doing their work in a very thorough manner. The ordinance recently passed ordering quarantine of animals, when necessary, has had a very salutary effect, stopping, to a very large extent, the killing of animals, the meat of which is unfit for human consumption. The following condemnations have been made for the year:

Cattle, beef, number	3
Sheep, "	83
Calves, "	60
Hogs, "	4

ARTICLES CONDEMNED IN MARKET.

Beef, pounds	2,524
Veal, "	1,190
Mutton, "	872
Pork, "	550
Sausage, "	505
Poultry, "	3,317
Fish, "	2,075
Rabbits, number	126

The above is a summary of the principal work accomplished by our Board for the year just ended. We hope, by the first of the year 1887, to have most of our ordinances passed, after which they will be formulated in a code and published.

GLOUCESTER COUNTY.

GLASSBORO TOWNSHIP. - *Report from* JACOB ISZARD, M.D., *Sec'y.*

The drainage is not so very good, on account of the flatness of the soil. Since last year (1885) there has been a terra cotta pipe laid on the east side of the town, which has improved that part of the town

very satisfactory to the inhabitants. The water-supply is from wells and of a good quality.

The streets and public grounds are kept in good condition.

The refuse is fed to pigs and chickens. The excreta is hauled out of the town by farmers, who ask to remove it on their farms as a fertilizer, and it is generally done in the winter time.

The manufactories and trades are principally the making of glass, window-lights and bottles. During the present year there has been a shoe factory planted from Philadelphia, employing about forty men and women.

There have been no contagious diseases during the past year.

There has been a decrease of malaria the past year.

HARRISON TWP. - *Report from* E. E. DEGROFFT, M.D., *Sec'y.*

Our water-supply is principally obtained from wells, although there are a few families who depend upon cisterns, during the winter months, for their supply of water. During the past year the water has been excellent and free from contamination, and with few exceptions there has been an abundance of it.

We have no sewerage system other than that provided by nature. Our village being located on a hill, all impure substances, after a heavy rainfall, immediately passes into a stream or mill-race in the center of the town.

Our streets are wide and are kept in a clean and healthful condition, no garbage or decomposed vegetable matter being permitted to remain in them at all.

Many of our houses are poorly ventilated in consequence of the windows in the older buildings not being arranged so as to lower from the top. All the houses have cellars, some of which are used for the storage of vegetables. There is no annual house-to-house inspection.

Privies have open bottoms, and the excreta is removed by horse and cart and buried in the earth.

Our township has been remarkably free from malaria this year, and the only prevalent diseases that we have met with has been tonsilitis and dysentery. There has been no hog cholera and no pleuro-pneumonia among cattle in this community that we have been informed of.

LOGAN TOWNSHIP. - - *Report from* S. B. PLATT, *Secretary.*

Drinking-water is derived entirely from wells. There is no taste of iron, and water is principally hard. Nearly all houses are provided with tanks or cisterns in which rain-water is caught and used for washing purposes.

There is no drainage distinct from sewerage, and the water-level is such as to secure dry cellars generally. Where cellars are subject to overflow, tile are laid to a lower level which drains the same. There are very large swamps in the township, some of them very low and malarial, and malaria is frequent.

Houses generally have cellars which are not much used for storage of vegetables, as nearly all of the farm-houses or dwellings have separate cellars for the storage of same. There are not more than two or three tenements that have more than two families. There is no yearly house-to-house inspection.

No sewers used. No cesspools. Water-closets are to some extent made with tight sides and bottoms, and there is more attention given to this matter each successive year.

The contents are generally removed during the winter months and used for fertilizer.

There is no contagious disease of animals reported, excepting hog cholera, which is not serious, only four or five cases. Farmers are keeping cleaner pens and giving more attention to the care of hogs, as they believe prevention is better than cure.

Slaughter-houses, two; which have been inspected and the owners notified to keep them in better sanitary condition, which has been partly complied with.

There have been no prevalent diseases this year, and think we can say that the past year has been remarkably healthy in this district. The health laws are being better understood, and, consequently, better appreciated and observed.

MONROE TOWNSHIP. - - *Report from* L. M. HALSEY, M.D.

The sanitary condition of Monroe township has been very much improved in the last two years. The people are taking more interest in it. The water-closets are very much better. In a great many cases they have boxes in which they use earth or sifted coal ashes and empty them frequently. Pig pens, which were a source of great

trouble to the community, have been almost entirely abolished within the town. Dysentery has not been so prevalent this year; not more than one-third of the cases that we had the two previous years. In the spring, we had an epidemic of measles; this fall, an epidemic of whooping-cough. Typhoid fever is making its annual visit, but not of a serious type. Some little pneumonia, but of a mild character. On the whole, the township is in a good condition.

SOUTH HARRISON TWP. *Report from* S. F. STANGER, M.D., *Sec'y.*

The refuse is mostly fed to pigs and chickens, but in some cases thrown outside the kitchen door. We have some malarial fever during the spring and fall, but has not been so prevalent as during the past few years, accounted for, probably, to some extent, by the fact of the water in the mill-pond (which is situated in the village) not being so low as in former years.

Rheumatism has been more prevalent with us than for some time past. During November and December there was a general epidemic of influenza. In connection with it there was an unusual number of cases of rheumatism.

No contagious diseases among domestic animals, except in one herd of cattle which were afflicted with pleuro-pneumonia, but the disease did not extend.

Water-supply is derived from wells and cisterns. Well-water is very hard, and during the months of August and September it becomes very offensive and not fit for drinking.

WASHINGTON TOWNSHIP. *Report from* CHAS. D. NICHOLSON, *Sec'y.*

The township is perfectly healthy at present; no ague prevails, or fevers, as is usual this time of year.

HUDSON COUNTY.

HUDSON COUNTY. - - *Report from* C. J. ROONEY, JR.

The diseases which, when compared with the average, show most plainly a decrease of mortality were diarrhœal diseases and scarlet fever.

From scarlet fever the deaths were 91. In the previous eleven years the deaths were as follows: 245, 167, 170, 249, 163, 131, 232, 113, 213, 183, 114.

The marked decrease of the number of deaths from scarlet fever, below the average for so long a period, would suggest that a cause be sought for.

Coincident with this decrease was a new rule of this Board, a system of report, inspection of contagious disease and notification of school principals, which resulted in the exclusion from the schools, public and private of this county, of any child affected with any of certain communicable diseases, of which scarlet fever is one.

This rule has been carefully carried into effect, with the co-operation of the school principals, many of whom have expressed their gratification with the Board's efforts in the direction of affording protection to the school children and preventing the spread in the schools of contagious diseases.

It does not seem to be an unreasonable inference to assume that this new system of the Board is to be credited with the decrease of mortality from scarlet fever.

There have been no epidemics during the year.

There were two deaths from small-pox, one in November and one in December, 1885. Both cases originated from contact with persons who had just arrived on steamers from Europe.

By suggestion of this Board, the honorable the Board of Chosen Freeholders have arranged to so alter the small-pox hospital at Snake Hill that by means of additions it will be able to accommodate cases of contagious disease other than small-pox. This will enable this Board to provide for the cases of contagious disease requiring removal from home.

The Board has enforced the ordinances against certain physicians who had neglected to comply with the law as to vital statistics, and for the past few months the good effect of this action has shown itself in a much fuller return of births.

Public funerals in cases of contagious diseases have been prohibited by ordinance and due notice sent to undertakers.

The dairy stables of the county are visited frequently by Inspectors, and in most cases were found faults of construction, drainage and management. In all cases these faults have been corrected; in some cases not without suit. In one case a large dairy of the swill-milk class was driven out of the county.

Slaughter-houses, cow-stables and places in which are carried on noxious trades, are visited at least once a year. The result of this system is found in the greatly improved manner in which these places are conducted. Inspection by experts of all cattle in the county, with a view to discovering the facts as to the existence of pleuro-pneumonia and controlling its spread, engages the attention of the Board.

A large number of suits have been brought and carried on by the counsel, in all of which the Board has had decision in its favor. There is not nearly so great a tendency now to resist the enforcement of ordinances as formerly.

An immense amount of work in the shape of inspections has been done by the Inspectors in cases of contagious disease and of nuisances, and many nuisances of long standing, hitherto resisting all efforts of those residing in the vicinity, have been abated.

The citizens of some of the outlying towns have asked and received the aid of the Board and of its Inspectors and counsel in securing the removal, by their own local authorities, of certain unsanitary conditions.

The removal of night-soil seems to be as far from being done satisfactorily as ever. It would seem that another scow provided in the county would come near to practically solving the problem.

HUNTERDON COUNTY.

DELAWARE TOWNSHIP. - - *Report from* A. W. MUIRHEID.

The health of the township has been good during the past year, no epidemic prevailing.

The water-supply is obtained from dug and driven wells and from springs.

The drainage is perfect for the reason that the dividing line between the waters of the Raritan and Delaware rivers passes through about the center of the township, the water of the former running east whilst that of the latter has a westerly course.

There is but one slaughter-house within the limits of the township and that is kept in a proper manner.

Only one complaint of nuisance has been reported to the Board this season, which they immediately investigated and notified the parties concerned, who abated it as soon as it was possible for it to be done.

EAST AMWELL TOWNSHIP. - *Report from* P. C. YOUNG, M.D.

The health of the township for the past twelve months has been better than the preceding year; have had less zymotic diseases.

If at any time we should be visited with an epidemic, I shall gladly inform you of its nature, and conform to all the requirements of the laws.

KINGWOOD TOWNSHIP. - *Report from* GEO. E. DALRYMPLE, *Sec'y.*

The general health of the township has been good during the past year; no prevailing disease has occurred. Only one complaint has been before the Board as a nuisance, and that was soon removed.

LAMBERTVILLE. - - *Report from* GEO. M. HOLCOMBE, JR.

Water supplied by a private company, and is soft. It sometimes has a bad odor in warm weather, but an analysis shows it to be pure. It is taken from Swan's creek, and no sewage empties into it above the point of supply. No examination made of the stream. People generally depend on cisterns and wells.

A yearly house-to-house inspection is made.

Cesspools are used, with open bottoms, and are cleaned by a person under charge of the Board, and the contents removed beyond the city limits. Excreta removed by the same person and disposed of in the same way.

Diphtheria was quite prevalent during the past year—about twenty-five cases and a few deaths.

The Board has been very active during the past year.

All hogs and pens have been removed from the city limits.

Houses and premises have been inspected very thoroughly, and found principally in good sanitary condition. In a few cases nuisances were found to exist, which have been abated.

LEBANON TOWNSHIP. - *Report from* A. S. BANGHART, *Sec'y.*

The past year has been healthy in our township; no epidemics have been with us this year. Our Health Board is active, obeys all summons and in all cases strive to do its duty, which has added greatly to the health of our township; vaccination is well attended to.

RARITAN TOWNSHIP. - - *Report from* J. H. EWING, M.D.

The water-supply is by private company; about one-third of the houses of Flemington take the water. The water is taken from the South branch of the Raritan river, and sometimes after a rain the water is discolored; the water is soft and has no bad taste. The reservoir and pipes are cleaned occasionally; no sewerage in stream nor other mode of pollution. Very few use wells, but a good many use cisterns. The people outside of the town use wells and springs for drinking and cooking, and cisterns for stock and washing purposes.

There are three drains, (terra cotta pipe, twelve to fifteen inches,) draining from five to ten houses each, and they have their outlet in the natural water-courses just at the edge of the town. The cellars are generally dry.

Very few cesspools (three or four); not cemented, open bottom and sides. The contents when emptied are used for manure.

The slaughter-houses are kept in a sanitary condition.

TEWKSBURY TOWNSHIP. - *Report from* O. A. FARLEY, *Sec'y.*

There has been no disease prevailing as an epidemic or endemic.

Malaria exists in some parts of the township, and there have been a few cases of typhoid fever, and these of a mild type.

MERCER COUNTY.

CHAMBERSBURG. - - - *Report from* JAMES H. TINDALL.

We derive our water-supply from the city of Trenton water-works. About 1,500 consumers take the water. The water is somewhat discolored during freshets in the Delaware. The water-pipes are cleaned out by the chief of the fire department turning on the fire-plugs.

We have no tenement-houses. A house-to-house inspection has been made by the Health Inspector during the past summer.

In reference to cesspools, they are chiefly brick sides with open bottom. They are emptied by scavengers, at the expense of the owners of property. The contents are used as fertilizers.

The slaughter-houses in the borough are regularly inspected during the year by the full Board of Health, they going in a body to all such

places about four times a year, and oftener if any complaint is made from the neighborhood where they are located.

Our manufactories are chiefly iron works. We have one soap manufactory, which causes some trouble to the Board at times, by the residents in the vicinity making complaints of the stench arising from the process of boiling the fatty substance, which at times is very offensive, and is, in the opinion of the Board, detrimental to the public health.

The public schools have been visited by a majority of the Board, who find that they are not satisfactorily ventilated, some of the heating apparatus not having cold-air conducters. The Board have made several complaints as to this matter to the school authorities, but nothing has been done to remedy the matter. The damp air of the cellars is sent up into the school-rooms, which makes the rooms smell musty and oppressive if you stay in them any length of time. Something should be done to remedy this matter, as the Board consider it detrimental to the health of the children. The State Deaf and Dumb Institute is in a very good sanitary condition. Every department is thoroughly ventilated, and the Board of Health spoke very highly of the general workings and health of the institute when they visited it a few weeks ago.

HIGHTSTOWN. - - *Report from* THOMAS C. PEARCE, *Secretary.*

The borough is about one mile in length from north to south, and about half a mile wide, with a pond on east border of the town. If we take the level at the aforesaid pond, Main street would average in the business portion two to eight feet high, while the northwestern would average from eighteen to twenty feet, so you see by this statement the business portion (the most important to health) is on very low ground and with no material sewerage. A small stream passes through the center of the town. Several privies are upon it, and it is also used to throw debris, &c., in.

The supply of water is generally obtained from wells, and in one case through pipes from a spring to a hotel.

Sewerage is mostly into pond and the aforesaid stream passing through the center of town. Peddie Institute has a drain pipe from main building leading to pond, and the shirt factory have something of the same sort.

Streets are now in very good condition. The council appoints a

committee to attend to the aforesaid. We have one public park, containing about four acres, which belongs to the Hightstown Land Improvement Association, but it is in very bad condition and is never used as a place to rusticate.

Two slaughter-houses are not in very good condition; one slaughter-house situated near a dwelling.

MILLHAM TOWNSHIP. - *Report from* JAMES E. CLINTON, *Sec'y.*

The water-supply is partly by the city of Trenton water-works and principally by wells. Nine-tenths depend on wells at present, but nearly one-half will be using the city water in another month. The well-water varies in taste, some is hard and irony, some is soft and some smells so badly that it can't be used, and are constantly being filled up. Cisterns, we have none.

As to drainage, there is no system except in one case, and that is constructed with terra cotta pipe. It is the worst place in the township to be drained. The water-level is good, except in the instance above referred to, in the principal part of the township. We are surrounded with swamps, and malaria is quite prevalent in the spring and more particularly in the fall.

The out-houses are all built on the rear of the lots, which are principally 100 feet deep. They are dug to the depth of from 5 to 6 feet. None are cemented, for the ground is naturally sandy at the depth of 3 feet. They are emptied by night scavengers. We have more trouble with filthy out-houses than anything else, but they comply when we take them in hand.

PRINCETON. - - - *Report from* JAS. R. DRAKE, *Sec'y.*

As to sewers, we have no general system. The College of New Jersey has a private system of surface distribution for their sewage. Cellars are dry, with some exceptions, in parts of the town where the ground is almost level. There are no swamps very near, yet malaria is quite frequent.

Sewers are used only by the college for their buildings. Their pipes empty into distributing troughs on a lot on the borough line, the liquid matter is absorbed by the ground and sun and the thick matter is mixed with ashes and used as compost. Throughout the

town cesspools, both cemented and open-bottomed, are used, and are cleaned, generally, by being pumped into air-tight barrels and carted away and disposed of to farmers for fertilizer. We have no perfectly odorless excavating apparatus at present, but expect to have in the near future.

Members of the Board are furnished with copies, and abstracts of them and circulars are often published and circulated throughout the town. Considerable difficulty is experienced in getting the people at large to believe in the virtue and the necessity of enforcing ordinances.

All legal and persuasive means are resorted to in resisting possible epidemics and the spread of contagious diseases.

TRENTON. - - - *Report from* WILLIAM CLOKE, *Secretary.*

The following annual report just made by Health Inspector McGuire, gives a pretty clear and comprehensive account of the operations of the Trenton Board of Health for the past year:

"The sanitary condition of the City Hall is very bad. The sewage from the whole building empties into a cesspool in the cellar, and the offensive odor arising from this source fills every office, so that at times it is almost impossible for officers to transact business. The janitor in charge of the building does all in his power to keep the place in proper condition, but as long as prisoners are kept in the building, with the cells located as they are at present, there can be no improvement.

"The public schools are in about the same condition as last year. The greatest source of complaint during the year has been the foul condition of the Assanpink creek; this has been especially so in the summer season. Citizens have complained that the stench arising from the creek has made living near it almost impossible, and the time is not far off when strong measures will have to be adopted to stop the increasing flow of filth into this stream.

"I have devoted considerable time during the year to house inspection, with the result of abating many nuisances, and making many improvements. In this connection I have found a great deal of defective plumbing, especially in soil-pipes leaking at the joints.

"The purity of the drinking-water supplied by the city is well known, and needs no comment from me.

"There are considerably less wells used now than last year; citizens who have been using well-water are having the city water put in, and no doubt at the end of the next year there will be but few wells used for drinking-water.

"I have given considerable attention to the milk-supply of our city, and I am glad to say that the quality of milk sold here cannot be surpassed in any city in the State.

"I have also given some attention to adulterated food, and have submitted various samples to the chemist for analysis, the results of which have been such as to convince me that more care should be given to the subject."

The Board's sphere of usefulness has recently been largely increased by the appointment of Mr. Charles Hewitt as analytical chemist. His labors have already resulted in exposing and preventing the continued use of some dangerous well-waters. The Board purposes making use of his services in various important directions.

I expected to be able in this annual report to announce the passage by common council of an ordinance to supply this city with sewers, but this much-needed public improvement was defeated by a close vote in council, and is again indefinitely delayed. It is hoped that a modified plan will soon be introduced and promptly passed, which will meet the necessities of the central and thickly-populated parts of the city.

WEST WINDSOR. - - - *Report from* JOHN C. YARD.

We have no towns in our township, and but few villages, and they are small, and our water-supply is from wells, springs and cisterns. Our township is mostly well drained, and but few boggy or marshy places. We have no slaughter-houses or any places of a foul nature. Our refuse is generally carted out and put on the land.

No contagious disease this year. Some malaria in township. Some sickness in cattle, but no epidemic. The cattle that were sick have been carefully looked after.

Our people are learning to look after the health of their children and teaching them to look after their health.

MIDDLESEX COUNTY.

EAST BRUNSWICK TOWNSHIP. - *Report from* W. H. THOBURN.

We had but one meeting of the Board, which was held at Milltown, on account of an epidemic of typhoid fever, and notified the

people of that section to clean and disinfect their water-closets. This is all I know of to report; should there be anything further, I will give you more particulars.

NORTH BRUNSWICK TOWNSHIP. - *Report from* J. A. WINES.

Pneumonia and typhoid fever somewhat more prevalent than in former years, with perhaps the exception of last year.

PERTH AMBOY. - - *Report from* E. B. P. KELLEY, M.D.

The city water-supply, furnished by a private company, is supplied by springs and surface-water. Owing to scarcity of water the past season, the main dam has been raised four feet, with view to greater capacity. The water being highly discolored, many families object seriously to using it for drinking purposes. This water is used freely during the warm season for flushing the sewers.

Two new brick sewers have been built in the past year. Several large ponds of a dangerous character have been drained and filled, which has added materially to the health of that part of the city.

The streets and public grounds have been kept in better condition the past year than heretofore.

Refuse and excreta are carefully moved beyond the city limits.

Public health has been very good, no epidemic diseases during the past year.

Vessels entering this port are rigidly inspected at the quarantine station.

SOUTH BRUNSWICK TWP. *Report from* CHARLES L. STOUT, *Sec'y.*

The general health of the township for the past year has been excellent. No epidemics have prevailed, and no complaints have been made to the Board. More attention is being paid to sanitary laws than formerly.

WOODBRIDGE TOWNSHIP. - *Report from* JONAS H. CODDINGTON.

Meetings of the Board have been held every two weeks during the summer months.

Notices have generally been complied with without resorting to extreme measures.

The health of the township has been excellent during the year.

MONMOUTH COUNTY.

ASBURY PARK. - - - *Report from* RANDOLPH ROSS.

During the past year the construction of the water-works has been completed. A water-tower, 125 feet high and 12 feet in diameter, with a capacity of 100,000 gallons, has been added to the works. One hundred and sixty-five connections have been made to the water-mains and new connections are being made daily.

The Board of Health has continued to cause examinations to be made of the water of suspected wells, and all wells found to be polluted are promptly closed. Fourteen analyses of water have been made and eight wells have been closed.

The sewers have worked admirably during the past summer, and there have been no complaints of odors from the outlet. During the past year, October 15th, 1885, to October 15th, 1886, we have sent 225 notices directing attention to unsanitary conditions. There have been 1,625 inspections and re-inspections of buildings and premises.

Eight cases of reported contagious diseases have been investigated.

Twelve children have been excluded from school on account of contagious diseases.

Twenty-two samples of kerosene oil have been examined and all found to be up to the standard fixed by law.

Since the organization of the Board, suits have been ordered in eighty-seven cases; thirty-three of these cases have been brought to trial; twenty-nine convictions have resulted.

Gas and the electric light have to a considerable extent superseded kerosene as a means of lighting streets and dwellings.

A marked improvement is being made in the character and condition of the roadways and sidewalks of the public streets in the borough.

This work is being accomplished by the execution of the borough ordinances by the Board of Commissioners.

A very general tendency exists toward the ornamentation and adornment of private grounds, door-yards, &c., and we fancy that in this

fact there is evidence that the neatness and cleanliness heretofore required by this Board is bearing fruit, and trust that the taste and inclinations of residents are to supplement the sub-surface improvement and renovation which has been going on in this borough for the past six years. In accordance with an ordinance passed by the Borough Commissioners about one year ago, all new buildings erected within the limits of Mattison, Railroad and Lake avenues and Emory street are being built of brick.

From a sanitary point of view this fact is fortunate, for we find that property owners are more willing to put first-class drainage works in and about valuable brick structures than they are where the building is a cheap wooden affair.

The public school building has been enlarged during the past summer by the addition of two wings, each 22x29, and its lighting, drainage and water-supply are satisfactory, the latter being from the city works. The heating of this building is by hot-air furnaces, and provision has been made for ventilation.

FREEHOLD. - - - *Report from* W. J. MCCLURE, *Sec'y.*

This Board has resorted to precautionary measures rather than to the enforcement of ordinances, and finds that an occasional reminder accomplishes the desired end.

Our town has continued to be healthy, and with no epidemic diseases.

The only death from typhoid fever was traced to using impure well-water. To settle this question effectually, a small quantity of the water was analyzed and pronounced bad and unfit for potable use, being polluted with surface drainage and percolations from a near-by privy. Notice to the occupants of the premises to discontinue the use of the water has been followed with good results, and it has been used since only for cleansing purposes.

We are of the opinion that other wells are in a similar condition, but unless urgent measures require an inspection they do not come to our knowledge.

Complaints are occasionally made of unpleasant odors from fat rendering at the slaughter-house, and from hog pens and emptying of cesspools. These and others nuisances are disposed of without the enforcement of the penalty, and the Board feels that some good has

resulted from the efforts of the past year, and that our town compares favorably with others of its size in its sanitary condition, being without sewerage or a water-supply other than that obtained from wells or cisterns.

The attention of physicians having been called to the law in relation to vital statistics, the result has been a more complete return of births and deaths to this Board.

FREEHOLD TOWNSHIP. *Report from* O. R. FREEMAN, M.D., *Sec'y.*

The past year, outside of the incorporated limits of the town, has been one of very general good health, no epidemics of any contagious diseases have prevailed in any part of the township. There have been less cases of fever of any form, either of malarial or of a typhoid type, than in former years. There has been no complaints to the Board of Health, as in past years, from the improper storing or use of manufactured manures, so as to be dangerous to the public health.

About the middle of September a drove of some forty head of cattle arrived in the township, and were distributed on six different farms, in an apparently healthy condition. In about two weeks after their arrival sickness was discovered among them in several herds, and in less than one week from the discovery of any disease there were seven deaths in four different herds. An examination, by order of the State Board of Health, showed the disease to be Texas cattle disease, or splenic fever. The contagion had been communicated to them before their arrival here. After a thorough examination of their symptoms, and the application of remedies indicated by those symptoms, and a thorough quarantine, the disease was at once checked without further loss or communication to other herds of cattle.

MATAWAN. - - *Report from* BENJAMIN GRIGGS, *Sec'y.*

In the upper part of our borough and adjacent vicinity during the spring and summer we had quite an epidemic of dysentery, which in most cases yielded to prompt medical treatment. In most of those cases that proved fatal there was a complication of other diseases and infirmities. There has been no cases for some time past.

Our Health Inspector, Mr. P. C. Disbrow, reports the sanitary condition of our place as remarkably good at present. Some few cases of complaint during the summer of pig pens, etc., were promptly abated on notice to that effect by the Inspector.

MIDDLETOWN TOWNSHIP. - *Report from* R. S. SNYDER, *Sec'y.*

Naturally the drainage is good, requiring very little help, except where there are summer boarding places and hotels. Much attention, you know, has been given to drainage at the seaside with very beneficial results.

At those resorts the local Board have kept close watch and prevented any danger.

The roads have been the subject of much remark on account of the general improvement. They have been made as good as park drives in many road districts. The hilly portion is difficult to maintain when the floods of rain come.

Refuse, as a rule, is either made into compost at a safe distance, or burned or buried or placed below low water at sea. The excreta is used by farmers as fast as vaults require emptying, or buried in some localities to prevent any unwholesome smells.

Returns are generally made, but in a township having villages, containing churches and undertaking establishments, and where doctors reside, the returns are mostly carried to the assessor of the township in which the village or town is located, so that the rural township cannot or rather does not get the returns for his township, and therefore such townships are short of their true returns, and the other township containing the villages have more than belongs to them. There should be a law enforced requiring all returns sent to the proper officer of the township where they belong.

A family afflicted with small-pox was at once quarantined by us, and although the house was within a few feet of houses on each side, and in the midst of a large number of houses, it was confined to the family where it broke out.

The cause of the disease was obtaining bedding from the shore, evidently from a vessel having the disease on board. The whole village was vaccinated by two doctors, and every precaution taken to prevent the spread of the disease.

The expenses were paid by the township and amounted to no inconsiderable sum.

OCEAN GROVE. - - - *Report from* A. E. BALLARD, *Sec'y.*

The carrying away the contents of unconnected privies and cesspools to a distance of two miles and burying them is beginning to be attended

with so much cost and offensiveness to property owners as to induce more rapidly the construction of sewers and their connection. The difficulties and cost increase so rapidly that the Association believes that a voluntary settlement of this question, by which every property will be connected with the sewer, will result at no very distant date.

The garbage question is manageable now, but presents for the future a case of difficulty. It is now taken away every day at a cost of about fifteen hundred dollars for the season, partly fed to animals by the contractor and partly buried. The amount is largely on the increase, and the occupancy of the adjoining property is becoming more extensive. The needs of health will probably prevent the present mode of disposing of it, and the Association is carefully considering all the various methods proposed by hygiene as to what will be the best when the present system is compelled to change.

There was a full inspection by the Board of Health of all the properties in the Grove before the opening of the season. Wherever sanitary needs were discovered they were met at once without delay, where the owners could not immediately be reached. The Board was careful to record all the reasons which made the necessities, and have the gratification of reporting that in no case has there been any difficulty in the settlement of the bills. A general inspection is continued through the summer, and the Board believes that no serious case has escaped their attention. All classes of employes, icemen, garbagemen, tentmen, policemen and people generally, are expected to report to the Inspector anything they either see or suspect. Large numbers of these reports are baseless, but in many cases they are valuable in reaching sanitary violations which otherwise might elude discovery.

There has been no special epidemic, and only one case reported of contagion. The case was light and yielded easily to medical treatment. There were two or three cases of light fever which the parties attributed to the property surroundings, but the physicians did not so report them.

The sewer extension, which at a very heavy cost was carried out for a distance of 500 feet into the ocean, and of whose permanency as well as competency to do the work required of it there were grave doubts, has demonstrated a complete success. The discouragements incident to the experimentation—when the whole structure, costing between four and five thousand dollars, was rendered useless by the toredo worm, and which required a much higher outlay to replace it

with iron piling driven in accordance with the latest and best inventions of modern science, and galvanized iron piping through which to discharge the sewage—these discouragements have been overcome by the new structure, which, during the time of its operation, has not manifested any symptoms of giving way, either to the violence of storms or the pressure of floating masses of wreck. No difficulty has been experienced in the sewage discharge. The highest tide of the year only held it back a single block for a couple of hours without any overflow of which we could learn, and which did not cause any disagreeable or offensive effluvia. No offensive odor is perceptible in the sea at the point where it is entered by the sewage, and the slight discoloration extends but from three to five feet. There has only been one instance where the connecting pipes have been choked, which was among the tents, and which resulted from an imperfection in the construction. A few cases have occurred where the pipes from dwellings have been stopped by carelessness, but there has been no difficulty in their speedy relief. There has been an extension of the main sewer-pipes. The number of new connections is 96, making in all ten and three-quarters (10¾) miles of main pipe and 415 connections.

It was intended to do more in this department the present year, but the great destruction to the sea-front occurring from the winter storms so absorbed both energies and opportunity as to lessen the attention to every other enterprise. The coming autumn and spring, it is hoped, will witness a large advance in this direction. The Association reports its appreciation of the interest and advice of the State Board, which has been freely given them in all stages through which their plans have advanced to the present gratifying success.

The question of water-supply, which was supposed to be fully solved by the artesian system of wells, developed unexpected embarrassments. The first well, whose experimentation cost between three and four thousand dollars and flowed 50 gallons per minute, was reduced nearly one-half by the establishment of another well by the Asbury Park authorities in immediate contiguity. This, however, was recovered by placing a small caloric engine with pumping arrangements. Two artesian wells had also been sunk by the Association in Broadway, which each gave a natural average flow of 30 gallons per minute. These were connected with the other and led into the general reservoir. But the pressure of the reservoir was so strong as to overpower the latter two and they drew water from it instead of adding to it. Another

well has since been sunk in a locality adjoining the first and connected with it, and a new and superior pumping engine established there, which now gives a regular supply of 140 gallons each minute, and is ample for all the present needs of the Association, both for fire and general use, with plenty for free flushing of all the sewer connections.

The number of connections with the water system during the year has been 54, which added to the 114 last year make a total of 168, with a number of orders for connections now on hand. The water and sewer systems are working together in such a way as to continually improve the sanitary condition of the Grove.

There are four and three-fourths (4¾) miles of water-pipe now laid.

The "lakes" have been kept in a condition which has apparently been conducive to general health. The constant outflow of their surface-water into the sea seems to fairly meet the health conditions.

The flow of an artesian well into Wesley lake, though not large yet, exercises a perceptible effect, while the fact that Fletcher lake is principally fed from springs at the bottom makes its waters generally pure. The upper end of the lake near the turnpike is not sufficiently deep to flow away rapidly, and for a block will probably be filled up and parked, or else put in shape for other purposes.

SHREWSBURY TOWNSHIP. *Report from* JOHN S. THROCKMORTON.

In the town of Red Bank there are public water-works owned by the town. Enough of the inhabitants now take it to pay running expenses and interest on the bonds. The water is excellent the whole year. Pipes are cleaned often by leaving open the hydrants for one day.

No drainage, except the natural fall, except a small brook in town used for all purposes, which is now receiving the attention of the Town Commissioners. Cellars are all dry with the exception of two that I know of.

Sewer is of brick; fall of at least five feet to the hundred, and empties in the river below low-water, and is about one-eighth of a mile in length.

As yet there has been no house-to-house inspection.

Thirteen houses connect with the sewer, the rest use cesspools; not

many cemented; emptied by force-pump into tight barrels and carted on the farms.

The township and town Boards have served notices in every case where a nuisance has been found, and in every instance, with one exception, the notices have been complied with without trouble.

UPPER FREEHOLD TWP. *Report from* H. G. NORTON, M.D., *Sec'y.*

Typhoid fever has been, for two years, prevalent in Imlaystown, during late summer and fall; this year there was a larger number of cases than last and of a severer type. It is narrowly confined to a portion of the town where the wells are shallow and, to even a superficial inspection, necessarily contaminated with animal refuse, slops, &c. An examination of the water of two of the wells, ordered by the State Board of Health, and made by Prof. Cornwall, shows their use to be dangerous. In view of these facts we have ordered the wells closed and cisterns substituted.

Whooping-cough was prevalent during the spring.

A number of nuisances have been abated, generally with cheerfulness.

A township code has been gotten into legal form, and been given wide distribution, so that now the Board feels better prepared to carry on the sanitary work entrusted to them, in which all take much interest.

MORRIS COUNTY.

HANOVER TOWNSHIP. - - *Report from* G. A. BECKER, M.D.

There has been some hog cholera but it was confined to the place where it originated. The owner of this place lost about one hundred hogs. There has been no other contagious disease among animals.

There are two slaughter-houses in the township. Complaint was handed to our Board concerning one of them, and upon investigation by the Board and health physician it was declared a nuisance and the owner ordered to remove it. He finally closed the place.

Prevailing disease has been of malarial origin, although it has been much less prevalent than last year. There has been much less sickness of any kind this year than last.

MORRISTOWN. - - - *Report from* JAMES DOUGLAS, M.D.

Aqueduct water. The aqueduct supply is by a private company; is mountain spring water; is pure and soft. The reservoirs and pipes cleaned whenever needed; it is impossible for the water to be contaminated by sewage. A few houses are supplied with cisterns and wells.

We have three houses with six or eight families and quite a number with two to four families.

During the past year there have been ten cases of scarlatina of a mild type and a few cases of whooping-cough. Mumps have been quite prevalent throughout the town, in a very few instances among adults, otherwise the health of the town has been remarkably good.

The Inspector reports that upon a thorough examination he finds that the rules and regulations of the Board of Health have been complied with.

ROCKAWAY TOWNSHIP. - *Report from* WILLIAM P. BRYAN.

There have been quite a number of cases of chills and malaria. We have attributed it to the present dry fall and the low water in the Rockaway river and its tributaries. We have thought that it would be advisable to request the Direct Process Iron and Steel Company to draw and dredge their pond, it being filled with debris. In times of low water like the present it breeds malaria and kindred diseases. This will be done. There have been some few cases of unhealthy or not properly-kept cellars and out-houses that have been promptly attended to upon request.

WASHINGTON TOWNSHIP. - *Report from* SILAS W. HANCE.

There is no examination made of drinking-water; probably one-fourth depend on wells. I do not think there are any that depend entirely on cisterns. A great deal of the water is quite bad just now, owing to the extreme lowness of the water.

Twenty-eight houses have more than one family; perhaps six have more than two. Houses do not generally have basements other than cellars. There is no yearly house inspection, no Inspector.

OCEAN COUNTY.

BRICK TOWNSHIP. - - *Report from* SIDNEY HERBERT.

Under the code of sanitary laws adopted in July, 1885, the Board of Health in this township has been enabled to do good work. It is a pleasure to report that no epidemics of any disease have prevailed throughout or in any section of the township. In East Brick (Point Pleasant and vicinity), where in 1883 and 1884 an epidemic of typhoid fever occurred, there has not been a single case of that disease this year.

The water-supply in the township is as yet derived mainly from wells. Probably before another year closes Lakewood will have water-works to supply that town.

Privies are carefully looked after. If one is found near a well it is ordered removed. In most of the towns the refuse and excreta are disposed of nightly during the summer season.

There are no slaughter-houses or abattoirs permitted within the limits of any town or village.

A local Board of Health has been established in the borough of Point Pleasant Beach, which has under its direct supervision that special locality.

When the citizens of the townships wake up to the realization of the importance of the work of the Board, and will lend their hearty aid in securing excellent sanitary conditions, then we feel that the work of the Board will be more efficient. Until that time there certainly will be deficiency in the work. Let the public schools teach the laws of health.

DOVER TOWNSHIP. - - - *Report from* E. H. WILKES.

We are happy, in offering to you our report from the township of Dover, to say that if the entire State were as healthful as our township a State Board of Health would be almost useless. So remarkably good hath been the health of our people this year that our physicians have been comparatively idle. It is their universal testimony that there has not been one-half the sickness this year that we commonly have. With an elevation of from twenty to sixty feet above the level of the river and no swamps partially overflowed around us, we are free from all malarial troubles. Our streets are kept clean, the drainage

good, and the very best of water, so that all these tend to secure health and happiness for our people.

Island Heights is getting to be quite a summer resort for invalids, and so remarkably healthful is the climate and so perfect are the sanitary arrangements that all who come to it for comfort declare themselves greatly benefited thereby. In fact, our entire township is free from all contagious diseases. No malaria, no chills and fever.

There is one suggestion that we would make to your honorable body, and that is with reference to our public schools. We think there should be a greater uniformity in the construction of our school-houses—a more perfect system in the sanitary arrangements of our school-houses, and an entire change in the plans of ventilation. To accomplish this it would be well to have each school-house inspected at least once a year by a competent expert.

MANCHESTER TOWNSHIP. - *Report from* J. R. STEELMAN.

The land needs but little drainage; there are no places of any size to require sewerage.

Manchester, our largest place, has only about 900 inhabitants.

All the houses are in a comfortable condition, and are perhaps as healthfully arranged as any others of the same class.

The railroad repairing shops for New Jersey Southern Railroad, located at Manchester, and jute bagging factory, located at Manchester, are all the manufactories in the township.

Most of the children have been vaccinated, but there are no arrangements made to isolate cases of a contagious character.

There have been no contagious diseases until within a few weeks past; some cases of diphtheria have occurred in Manchester.

This being in the pine belt of New Jersey, and but sparsely settled, is noted as being a very healthy locality.

PASSAIC COUNTY.

ACQUACKANONK TOWNSHIP. - *Report from* JOHN H. MERSELIS.

Generally cellars are used for storage of vegetables during winter. Very few tenement-houses—number not known. There is no yearly house-to-house inspection.

Cesspools are constructed in all the various ways known to those who generally use them. Emptied by pumps, buckets, &c. Contents removed and used for manure.

MANCHESTER TOWNSHIP. - *Report from* WM. D. BERDAN.

No sewers in Manchester. Cesspools are in all imaginable forms; some are built with cemented sides and bottoms and covered, with pump for pumping out contents. Some have open bottoms, some are merely a depression in the ground where slops and refuse collect, and occasionally the accumulations are carted away and used as fertilizers.

There have been about twelve cases of spinal meningitis among horses, with seven deaths. No other disease to report.

PASSAIC. - - - *Report from* JOHN B. PUDNEY, *Sec'y.*

Many of the cheaper houses are occupied by more than one family, particularly in the manufacturing district known as Dundee.

Public health has been very good. City has been generally healthy and laws regulating same enforced. All nuisances are promptly abated.

In case of appearance of small-pox, those attending public schools are required to be vaccinated.

PATERSON. - - *Report from* WILLIAM K. NEWTON, M.D.

The public water-supply has been satisfactory, as usual. Many public wells have been closed, but a great many persons still use water from wells situated in back yards, and all of which are more or less contaminated.

Seven cases of typhoid fever were traced to one well, which is now closed; four of the cases died.

About one and one-half miles of new sewers have been laid during the past year. Sewer connections are ordered immediately by this Board, and now very few houses fronting on sewered streets are unconnected.

SALEM COUNTY.

LOWER ALLOWAYS CREEK. - *Report from* W. SCOTT SMITH, M.D.

The supply of water is obtained from wells and cisterns. The water in the wells is used for drinking, that in the cisterns for washing clothes, dishes, etc.

The land is drained by means of ditches, which carry off the water in time of heavy rains to the creeks, mill-ponds, etc. The cellars are dry, except in very wet times. Malaria is not very frequent.

Houses all have cellars, but vegetables in the raw state are not stored therein. There are not more than five or six houses in the township occupied by more than one family; there is but one with more than two. The houses are observed by the assessor when assessing, and also attention given to nuisances.

There have been no prevalent diseases during the past year. The assessor has inquired concerning the losses of animals, and about contagious diseases. The loss of animals is small. The only contagious disease is the hog cholera, which at the present time has entirely disappeared.

MANNINGTON TOWNSHIP. *Report from* DAVID F. GRIER, *Sec'y.*

Malaria prevails to no great extent in the township, though occasionally cases come under our notice.

As to contagious diseases, we had, in the months of January and February of 1886, pleuro-pneumonia in the herd of John Dawson. The State Board took care of the cases.

We have had a renewal of the swine plague in our township to an alarming extent this fall, mostly in the northern portion of the township, commencing where it left off last year. Where it raged last year the hogs that passed through the disease do not have it this year. I do not know of a case of them having it. It is among this year's swine in those places.

PILESGROVE TOWNSHIP. - - - *Report from* H. CRISPIN.

No known prevalent diseases, and no contagious diseases, except a few cases of hog cholera and two cases of pleuro-pneumonia.

We have two canning factories. Complaint has been made to the

Board about their emptying their refuse matter into the creek. This matter we must give attention to next year, as one farmer claims he has lost stock on account of their drinking the stagnant water. We shall need assistance from the State Board to have this nuisance discontinued. Hundreds of fish die from effects of the acid from the tomatoes.

SALEM. - - - *Report from* JOSIAH WISTAR, *Sec'y.*

To the State Board of Health, Trenton, N. J.:

GENTLEMEN—In presenting this our report for the year ending October 1st, 1886, we are gratified at being able to state that the general health of our city has been good during the past year, we not having had any epidemics or contagious diseases to contend with.

The law allowing all cities of two thousand inhabitants and over to have a Health Inspector has been a great benefit to us, both by saving the individual members of the Board a vast amount of labor, and by affording the means for a thorough inspection of the premises of *all* our citizens at least once in each year, and it has resulted in greatly improving the sanitary condition of our city—the house-to-house inspection made during last summer showing a very marked improvement in the condition of cellars, back yards, out-houses, &c., from what was observed the previous year. The houses in our city are, to a large extent, occupied by the owners, they generally having cellars, but these are rarely devoted to living or eating-rooms; only one family generally occupying one house.

As mentioned in a former report, the public water-supply is from Laurel run, which was dammed for the purpose of forming a pond, the water from which is conveyed to the city in cast-iron pipes a distance of three and a half or four miles, the works being owned by the city. The quality of the water when it reaches the consumer has never been satisfactory, being much discolored from lying in a pond, the bottom of which is of peat or mud; the taste being also somewhat affected by it. In order to remedy this evil to some extent, during the year 1885 a large well, some twenty feet in diameter, was sunk so near the pond that the water from it could be conveyed to the same pipes, and to a depth that it was thought would insure a good quality of water, the upper or surface springs being prevented from flowing into it by a water-tight wall. The water from this well, though clear as crystal, and of pleasant taste, is unfortunately

very hard, so that for many purposes it is undesirable for use. It is much to be regretted that, after the outlay of a large sum of money in order to have a supply of pure water for public use, the result should be so unsatisfactory. As a consequence, the water from private wells is still to a very large extent, in fact, almost universally, used for drinking and culinary purposes. Though not particularly agreeable to the taste, being slightly tinctured with some substance, believed to be magnesia, it is considered perfectly wholesome.

We have employed a person during the past summer to flush and wash out the gutters in and near the center of the city once in a week, using the city water for that purpose. The central portion of the city being flat, with barely sufficient fall for drainage, renders something of the kind needful. The water in the city mains is also improved by being allowed to flow freely from the fire-plugs.

We have no public sewers, except two short ones used to convey the surface drainage beneath the street, and a short distance away to an open ditch, through which it is carried to the creek. One of these has given us much trouble, the foul odors arising therefrom having been for a long time a cause of annoyance and endangering the health of those living near it. There was found to be a defect in the bottom, and through our exertions it has been taken up and relaid with large terra cotta pipe eighteen inches in diameter with plenty of fall, and now appears to be entirely satisfactory. The question of more extended public sewers is one that will have to engage the attention of our citizens in the not distant future; but for the present the surface gutters, with some few private underdrains, have proved reasonably satisfactory.

The elevation of the surface of the ground is not great above tide-water, but our cellars are for the most part dry; the months of March and April of the present year, however, proving an exception, when the excessive rain-fall raised the springs so that more cellars had water in them than had been the case for a long time previous.

Since the introduction of water many of our dwellings have had bath-rooms and water-closets constructed in them, the drainage from these being carried off in underground pipes to a reservoir or cess-pool. One of our ordinances prescribes the manner in which privy-vaults, sinks, cesspools, &c., shall hereafter be constructed or rebuilt, and provides for their being frequently and properly cleansed; their distance from wells of water, &c., and we find that constant care is

required to prevent a violation of its provisons. They are emptied at night by persons having carts or wagons constructed for the purpose.

The slaughter-houses which have been alluded to in former reports as being a source of much trouble to us, have been finally removed to a greater distance from the built-up portion of the city, though still within the city limits, but they are so kept as to cause no annoyance to those living nearest to them. Our efforts to exclude them from our limits proved ineffectual, the Boards of Health of the adjoining townships interposing objections to their being placed within their jurisdiction; and, upon further considering the subject, it was thought better to retain them where we could exercise control over them, and see that they were properly kept, rather than to thrust them out where they might be placed near the confines of the city, and prove more of an annoyance than they had formerly been.

During the autumn and winter of 1885 a large proportion of the hogs kept in this city, as well as those in the surrounding country, were affected with what was called "*Hog Cholera*," for which there seemed to be no effectual remedy found, and many of them died. As a consequence, fewer hogs have been kept within our limits than formerly, which is quite a relief. It seems hard to deprive a poor man from keeping his hog, which he considers a source of profit, but it requires much care that they do not annoy those living near. The number of persons who lost hogs or other animals by disease cannot be ascertained, no inquiry having been made to that end. Neither is there a register of persons who keep horses, cows, pigs, &c.

Our manufactories are in much the same condition as at our last report. The four canning factories, as well as other factories, are well conducted, and cause no interference with the public health or comfort.

The necessity for a public cemetery has long been felt, as many of those connected with or belonging to the different churches were rapidly filling up; and during the past winter a company was formed by some of our public-spirited citizens, and a lot of sixteen acres secured in a convenient location, which has been properly laid out for a cemetery, and several interments have already been made therein. During the extremely wet weather of last spring it was very difficult to dig graves in some of the older burial grounds to the proper depth without being troubled with water. This subject claimed our atten-

tion, and we were compelled, in one instance, to notify the trustees of the property to re-inter the body, which was done.

The act of April 3d, 1885, by virtue of which local Boards of Health can have funds at their own disposal to defray necessary expenses, we feel to be a great aid in carrying on our work, as we were formerly much hampered in that direction, and were unable to accomplish certain sanitary measures which we felt to be desirable and expedient.

The longer we are engaged in the interesting work of caring for the public health, the more we are convinced of its importance, and the pressing need there is that the individual members of local Boards of Health should feel a deep interest in the subject, and be willing to put shoulder to shoulder to push forward the good work. While we feel we have accomplished some good results since our inauguration, four years ago, we are conscious there is much more to be done, not the least of which is to endeavor to form and stimulate public sentiment in the direction of wholesome sanitary regulations.

SOMERSET COUNTY.

BEDMINSTER TOWNSHIP. *Report from* WILLIAM P. SUTPHEN, *Sec'y.*

One or two instances of scarlet fever were confined to the houses of their first appearance by proper quarantine regulations of the Board. Due attention has been paid to the proper avoidance of pollution to the streams of the township, which the great drought of the fall made necessary. In one or two instances the Board had to act with firmness, and they are happy to say effectively.

BRIDGEWATER TOWNSHIP. - *Report from* JOSEPH B. SMITH.

There is no system of drainage, only private drains; most of the cellars are dry; no swamps, and very little malaria.

Houses generally have basements or cellars. In the towns, the basements are occupied, and some in the country are used for the storage of vegetables. About forty tenement-houses of more than two families.

There are a number of private drains. About one-half the houses connect with them. Some cesspools are cemented and others are built

with open bottom or sides. They are emptied by wagons, and the contents are taken and mixed with dry earth and used as fertilizers.

Assessor inquires each year as to losses of animals and as to contagious diseases.

There were a few cases of diphtheria in the town of Raritan.

HILLSBOROUGH TOWNSHIP. - *Report from* WESLEY H. HORNER.

We have no public health laws additional to the State laws. There is a disposition to pay more attention to hygienic matters, and the people are easily recommended to a proper course.

Due attention is given to registration and vital statistics.

Quarantine we practically know little about. Vaccination may be said to be in the hands of the physician. It is very generally attended to.

Ulcerated quinsy was very common during the winter. Also quite a number of cases of pneumonia and a few of rheumatism. Malaria has nearly disappeared.

I might have mentioned the occurrence of glanders among the horses of Jos. H. Van Cleef. The efforts of the State Board to limit the disease were successful.

MONTGOMERY TOWNSHIP. - *Report from* WILLIAM OPPIE, *Sec'y.*

The Board of Health have nothing in particular to report this year. Having been to every house in the township this summer, I would say I am very much pleased to find everything in such good condition.

No contagious diseases have prevailed with us during the year. The death-rate has been the smallest in many years, according to our township record that has been kept for a long time.

NORTH PLAINFIELD TWP. - *Report from* ISAAC BROKAW, *Sec'y.*

Abundant supply of as pure water as can be found in any section of the State; procured wholly by driven or drilled wells at an average depth of thirty feet; a natural surface drainage.

Streets and public grounds are kept in excellent condition; streets lighted by private property-owners and soon will be by electricity.

Refuse and excreta are attended to by each householder, carted away

and manufactured into fertilizers; public health exceptionally good, as the death-rate will show about 14 per 1,000. There have been no epidemic diseases during the past year. Two cases of scarlet fever during May last only, which were thoroughly quarantined and left no trace, and neither of them was fatal. We had one case of typhoid, which recovered. North Plainfield has formed a borough Board.

No complaints to the Board of Health to warrant harsh treatment, but all demands to abate trivial nuisances cheerfully complied with.

SUSSEX COUNTY.

MONTAGUE TOWNSHIP. - *Report from* BRITTON A. WESTBROOK.

Our water-courses here are almost as nature formed them, except—I will note one singlè exception that has fallen under my observation. Since our State has appointed Fish Commissioners, and our newspapers have published accounts of the advantages to be derived from the possession of private preserves for the propagation of "food fishes," several of our towns-people have thrown dams across small running streams, or across the outlets of swamps, and have thus formed rude ponds, and within the waters so created have placed some of the coarser species of fish. Now, though the possession of such places may be very gratifying to the owners, yet the whole surrounding neighborhood has been subjected to a perfect inundation from myriads of mosquitoes, where such pests were formerly unknown, and in every instance followed by an outbreak of fever and ague, something that I had never known before, although I have lived for over fifty years in this township. Of course such a state of things could have but one result, a general lowering of the average health-rate of the township, with no corresponding benefit resulting in favor of any class or profession, except, perhaps, the doctors.

NEWTON. - - - - - *Report from* GEORGE HARDIN.

Water is principally from wells, and filtered cisterns used; well-water is hard. Drainage and sewerage very poor. Streets and public grounds clean. Houses comparatively dry and clean. Refuse and

excreta carted out of town. Cattle free from disease. No complaint of nuisance. No appropriation for sanitary expenses. Most prevalent disease, typhoid fever.

SPARTA TOWNSHIP. - - - *Report from* JACOB TIMBREL.

There has been no disease prevailing as an epidemic during the past year.

The Board of Health has had but two complaints for the last year of nuisances, which, on notice, were immediately abated.

Our school-houses are as good as any in this part of the State, but I think their ventilation might be improved.

There has been no disease prevailing among cattle in our township for the past year.

Our slaughter-houses, of which we have four, have been kept in a clean condition, so as not to be a nuisance detrimental to health.

I am sorry to say that the returns of vital statistics, especially of births, have not been as well attended to as should be.

STILLWATER TOWNSHIP. - *Report from* C. V. MOORE, M.D.

The assessor reports to me that he has diligently inquired as to cases of diseases in animals during the past year, but has no cases to report.

No complaints have been made to the Board of Health of this township for the past year. It has been a year of unusual health. Much less malaria than usual.

VERNON TOWNSHIP. - - *Report from* H. H. DE KAY.

The health in this township has been unusually good the last year; the death-rate has been very small. No malignant or contagious diseases, and less malaria than there has been in ten years. No complaints have been made to the Board of Health.

WANTAGE TOWNSHIP. - - *Report from* NEWMAN HALL.

The Wallkill low-lands are partly embraced in this township. They are dry, except in winter and spring. Malaria has been prevalent in former years, but this year I have heard of no cases.

UNION COUNTY.

ELIZABETH. - - - - *Report from* A. R. REEVE.

There have been some cases of malarial fever, with a decrease in numbers since last year.

The sanitary condition of our city is good, with the exception of the system of emptying some of our sewers in the Elizabeth river, there being a very small amount of water, not sufficient to carry off the sewage as it should be. It will be readily seen that the deposit of animal and vegetable matter, the refuse of a considerable portion of the city, must contain elements deleterious to health. When, therefore, this stream is very much reduced by drought and exposure to the sun, with its bottom covered with filth and decaying matters, there necessarily obtains an unwholesome state of air about it. We look for some relief in this matter another year, either by placing a lock at the mouth of the river or by turning the sewers some other way.

FANWOOD TOWNSHIP. *Report from* F. W. WESTCOTT, M.D., *Sec'y.*

We have had very little sickness in the township the past year; especially marked has been the decline in malaria and the usual bowel troubles during summer and fall months. There have been a number of cases of tonsilitis of a light form. No diphtheria, and a very few cases of light scarlet fever.

We find the people very willing to comply with the health laws, and the officers of the health are respected and looked up to for public safety, as they should be. Very seldom has the Board been called upon this year. In one case of an improperly-kept dairy, we found milk had been taken to consumers in very dirty cans, poorly washed with impure water. This was promptly checked by the Board and has not since occurred. Taking things in all we have truly had a very healthy and quiet year.

Perhaps I should mention the case of a farmer losing about seventy-five hogs from cholera. The trouble did not spread from the farm. This occurred during the summer. At present we have no knowledge of any trouble with cattle.

NEW PROVIDENCE TWP. - *Report from* A. M. CORY, M.D., *Sec'y.*

The most noticeable fact in sanitary matters was the obliteration of a very malignant type of scarlet fever, which became centrally located among us during the summer, and was probably brought from a neighboring city. Five cases occurred, two of which were fatal. The annihilation of the disease, confined to two families, was effected by the prompt and decisive action of the Health Board and the unremitting vigilance and diligence of the Inspector in quarantining and freely using disinfectants. Disinfectants were used in the homes of the neighboring families by themselves. Attention was given to the destruction of books and papers exposed in the sick room, as they are believed to frequently be vehicles of contagion.

Without explanation or comment, we assert that one of the most necessary and practicable improvements to be made in rural as well as municipal districts, is the deepening of wells to secure a plentiful supply of good water, and prevent the evils consequent upon the exhaustion in ordinary periods of drouth.

SUMMIT. - - - - *Report from* W. H. RISK, M.D.

Summit is located, as its name indicates, on the top of the Orange mountains. Has a population of about 2,800. The climate is noted for its dryness and equability, and is, consequently, highly beneficial to those suffering from pulmonary troubles. Water is obtained from wells, and as a rule is of exceptional purity. Closed and cemented cesspools, well ventilated, are in general use.

The refuse and excreta are taken care of by odorless sanitary carts licensed for that purpose.

There are no cemeteries within the township. There have been no prevalent diseases during the past year.

PLAINFIELD. - - *Report from* WILLIAM C. BOONE, M.D.

The current year has been marked by special epidemic influences, fortunately of a mild type, and the city has suffered from the prevalence of certain maladies which should never have occurred.

In the southwestern portion of the city the sewerage is of such a defective character that it may well be questioned whether it is not a source of disease rather than a sanitary safeguard.

In many instances the inhabitants of this section empty their slop-water into the gutters and dispose of their excreta in badly-constructed privies, the contents of which percolate through the soil and pollute the surrounding wells.

And in this particular section have occurred, during the last six months, a large number of cases of scarlet fever, of a mild type, fortunately, in nearly all instances.

At the present writing three or four cases of diphtheria of a mild form have been reported.

A mild epidemic of mumps and whooping-cough prevailed in the earlier months of the year. During the summer we had comparatively few cases of cholera infantum. What few there were, with one or two exceptions, terminated in recovery. In these fatal cases, convulsions occurred. Ordinary diarrhœas were frequently met with, and offered but little resistance to the ordinary methods of treatment.

No well-pronounced cases of dysentery occurred—a marked contrast to the prevalence last year of this formidable disease.

Fever of a malarial character has prevailed to a mild degree, and is generally controlled by a few doses of bark or some one of its alkaloids. No typhoid fever has been noticed this season.

Our public schools are generally well ventilated and properly constructed, but in their present overcrowded condition are the agents for spreading the communicable diseases of childhood, and should have more stringent regulations regarding the admission of children coming from infected households.

INSPECTOR'S REPORT.

The city of Plainfield is situated in the eastern, middle portion of the State, about twenty-seven miles in a southwesterly direction from Jersey City. It has a population of about ten thousand. There are about three thousand acres of surface within the city limits. The climate is mild and genial, being agreeable and relieving to persons suffering from bronchial affections.

The water-supply is entirely from wells.

There is no system of drainage, unless cesspools accumulating the solids and allowing the fluids to saturate the adjacent soil may be so called. This system is already showing its effects upon the water-supply, and it can be a matter of very short time only before Plain-

field's *present* water-supply will be unfit for use. The property-owners of the Netherwood section have united in a system of sewerage, from their western slope, connecting from house to house and emptying into the fields between them and the city proper. A drain, partly open, receives the overflow from the cesspools of Hotel Netherwood, runs across the fields to the gutter of Leland avenue, thence across Le Grand and South avenues, under the railroad bridge, into North avenue, where it is lost. In its course it receives the overflow from several cesspools. Another drain, on the northern slope, receives the overflow of several cesspools, runs across the fields towards the railroad, and is lost; still another runs westerly under the gutter of Le Grand avenue to foot of hill, thence into field, where it is lost. The Peace street sewer, starting from the receivers at the railroad bridge on Park avenue along North avenue, tapped by nearly all the buildings on that street, running through an immense cesspool at the depot, which receives all the filth from that building, thence, with a tap from the receivers under the railroad bridge on Peace street, through Peace street, crossing Second and Front streets, runs under Stiger's lane into Green brook. The Somerset street sewer, starting at Front street and Park avenue, runs through Front and Somerset streets and empties into Green brook, under the Somerset street bridge, carrying much filth. The New street sewer, intended to convey surface-water into the brook, starts from Sixth street, with receivers at Sixth, Fifth, Fourth, Third, Second and Front streets, and empties into the brook. From present indications only surface-water passes through it. Another sewer runs through the Serrell property, Front street and Girard avenue, emptying into the brook. Although ample sureties forbid any but surface-water entering it, the mouth at times shows the surface-water far from clean.

These sewers are all amply washed out with every rain and are thoroughly ventilated at the receivers.

The Peace street sewer is 2,000 feet long; the Somerset street sewer 400 feet long; the New street sewer 2,100 feet long, and the Serrell sewer 1,200 feet long. They are stone or brick arches or tile of large size their whole length. The accumulations in the receivers are removed by the city's orders. Their grade is ample for practical purposes.

Nearly all the streets are macadamized, and but little labor or expense is required to make the road-bed of our streets unexcelled by any and equaled by few cities anywhere.

Reports of contagious diseases are made to the Board of Health and filed by the City Health Inspector.

Deaths are reported to the City Physician. Births and marriages are reported to the City Clerk. Co-operation of the schools and Health Board has enabled us to control contagious diseases. No provision is made for vaccination unless small-pox becomes prevalent.

The salary of the City Physician is $250 per annum; that of the Health Inspector is $375.

The only disease which has made itself conspicuous during the past year has been a very mild form of scarlet fever, of which there have been, up to December first, seventy-two cases. None have resulted fatally, except from injudicious exposure during convalescence.

UNION TOWNSHIP. - *Report from* D. HOBART SAYRE, *Sec'y.*

We have the honor to report that for the past year the health of the township has been good, above the average, as compared with the last five years.

No complaints of any kind have been before us. In the matter of roads, some improvement is being made, crushed stone coming in use instead of the old plan of building highways of mud or whatever is most convenient. When the tax-payer can see some visible improvement for his money he is willing to be taxed. In almost all the road districts special tax has been raised in addition to the general tax.

The water-supply has been, during the late fall, in some localities, nearly a failure, many wells giving no water. This going to the streams has been a hardship. It is becoming a question, if wells are to give an unfailing supply ought they not to be sunk below the rock which underlies this section?

WARREN COUNTY.

FRELINGHUYSEN TOWNSHIP. - *Report from* F. RORBACH, M.D.

The health of the township during the past year has been unusually good, in fact, fifty per cent. better than for any year since 1878. During the winter and spring months pneumonitis was quite prevalent, but not to the extent of an epidemic. The cases were mostly of

the asthenic type, but all recovered. No epidemics of any disease have occurred. Of scarlatina and measles, so prevalent the previous three years, but two cases of each have occurred. No cases of diphtheria, and but three of typhoid fever, of which one died and two recovered. Malaria still exists, but to so much less extent and modified form, compared with previous years, that little is thought of it. So far this fall (since October 1st) rheumatism and neuralgia have been the most prevalent diseases, the former generally sub-acute. In August and September a few isolated cases of dysentery of sub-acute type were met with.

During the past three or four years nearly all of the farmers of the township have been selling their milk, which, by relieving their female help from the hard, straining, dairy work, has resulted in a marked reduction in the number of cases of some diseases.

HARMONY TOWNSHIP. - *Report from* J. D. DE WITT, M.D.

We have nothing of any importance to communicate to your honorable Board, as, after a careful supervision of the health matters of the township, we find no special disease to report upon, as our township is one of the rural kind, without any towns or villages of any size; no manufacturing or any public works of any importance whatever.

Scarlet fever is now prevailing as an epidemic in the northern part of the township and in adjoining townships in a mild form.

HOPE TOWNSHIP. - *Report from* E. J. BERGEN, M.D., *Sec'y.*

The past year it has not been necessary to call the Board together for any purpose, nor have any complaints been made, excepting the months of February and March, when there was an unusual number of deaths from pneumonia. There has not been more than the usual amount of sickness. A few cases of scarlet fever have occurred, of a mild type and with no deaths. Two cases of diphtheria have come to my knowledge, with one death.

Hog cholera is now prevailing here, and I would suggest that if the people could be informed by circulars or otherwise that there is no recognized mode of treating it successfully, and that it is only suppressed by rigid quarantine and the mode of quarantine, so as to have

perfect isolation of the well from the sick, it would possibly be the means of saving to the people hogs that now contract the disease and die by being confined with those that have it.

LOPATCONG TOWNSHIP. - *Report from* JEREMIAH YEISLEY, *Sec'y.*

It is becoming evident that the precautions taken by order of the State are being greatly appreciated by the people at large in the care which is evinced to conform to and further all the requirements of the laws of health. The general health of the township has been good. The mortality list, although somewhat greater than the preceding year, can be accounted for by the increase of population, and the unprecedented number of deaths of aged persons, many a death being of a person over the age of seventy years, leaving the percentage at about one out of every hundred inhabitants. There have been no prevalent diseases of any kind, and no diseases among the cattle, and on the whole, the year ending October 1st, 1886, has been one of general health, and for which we return thanks to the Giver of all good.

POHATCONG TOWNSHIP. - *Report from* SOLOMON W. WIEDER, *Sec'y.*

No prevalent diseases this year to report; general public health good. An epidemic of measles has visited us, but without any deaths.

WASHINGTON. - - *Report from* F. M. COOK, M.D., *Sec'y.*

About five years ago water was introduced by a private company. The supply is from a mountain stream about three miles from town. The water is a little muddy at certain seasons, generally after a heavy rain; it has an irony taste, and as the company have cleaned the reservoir several times no fault has been found. About half the people take it, others are supplied by cisterns. Drainage is not very perfect, but as yet no epidemics have arisen from this. There is a small creek running through the southern part of the town into which several of the larger buildings have introduced drain-pipes, but the majority of the people depend upon holes dug in the ground, walled up and covered, and when necessary are emptied. All houses have cellars, which in some portions of town in the spring have water in them.

This has been a year free from endemics or epidemics of any kind. One case of typhoid fever was reported, but it was found to have originated from imperfect drainage. There was a cesspool about fifty feet from the house, twenty feet deep, walled up and covered, but without any escape-pipe over it; there were traps in all pipes leading to it except one, which was a six-inch pipe from the cellar to cesspool to lead off the water in case any should come in, so that all the gases escaped into the cellar. This pipe was ordered closed, and an escape-pipe put up over cesspool. Since then no further trouble has occurred in the house or neighborhood.

REPORT OF THE COUNCIL OF ANALYSTS TO THE STATE BOARD OF HEALTH.

INTRODUCTORY REPORT BY DR. ALBERT R. LEEDS, CHAIRMAN.

During the past year the official labors of the analysts have been chiefly directed to the examination of milk, natural and artificial butter, and to drinking-waters. The results have been seen in the great diminution in the sale of adulterated milk; in the restraint upon the fraudulent business in imitation butter (see report of Dairy Commissioner), and in the closing of dangerous wells, and in the improvement of many water-supplies. Prof. Cornwall has, in addition, made an inquiry into the subject of tobacco (not yet completed), and Mr. Shippen Wallace, an examination into canned foods. I desire to call attention more particularly to an inquiry into the amount of

CARBON DIOXIDE IN SCHOOL-ROOM AIR.

This topic has been extensively treated in a very valuable paper by the Secretary of the State Board, upon the general subject of heating and ventilation, which will be found in the ninth annual report. I shall, therefore, not discuss the importance of determining the percentage of carbon dioxide in dwellings, further than to reiterate that the air in a room becomes close, when as much as six per cent. of carbon dioxide is present, and stifling when there are more than eight parts. Also that the increase in the amount of carbon dioxide is usually attended with the increase of organic impurities, the most important of these being bacteria and fungi. On a future occasion I hope to present the methods, with accompanying results, of biological examinations of the air, made with a view of determining the kinds and numbers of these living microscopic germs.

Now, as relates to the determination of carbon dioxide (familiarly

though erroneously called carbonic acid), the first subject of study was to find a rapid and sufficiently accurate method. I tried that of Angus Smith, which consists in taking a series of bottles ranging in capacity from one to twenty avoirdupois ounces, and finding which one of the series gives a precipitate when containing the air under examination, and when this air is shaken up in the bottle with half an ounce of clear lime-water. Although this method is apparently very simple, it is in reality troublesome, and the results which I obtained differed widely from those found by the accurate method given below. For it is not easy to obtain a series of suitable bottles of clear white glass, with very wide mouths, as directed, and of capacities proper to accompany the table of volumes and the corresponding carbon dioxide percentages. The sides of the bottle must be cleaned from every trace of carbonate of lime left from a preceding experiment, and the first appearance of turbidity or precipitate, is a very delicate point to determine. After many failures I gave up the method and tried that of sucking air through a small bottle by means of an India-rubber ball and syringe. Using a two-ounce bottle containing half an ounce of baryta-water, a precipitate so milky as to prevent words written on a label in lead pencil from being clearly seen through the bottle, marks the end of the experiment. If a two-ounce rubber ball is used, and by squeezing and relaxing this ball, five times two ounces of air is drawn through the baryta-water, then in case the air contains 8.8 parts of carbon dioxide in 10,000, the standard precipitate should be produced. If the air contains 7.4 parts per 100,000, then six balls full of air must be sucked through, and so on as indicated by a suitable table.

I failed entirely in attempting to make use of this method, the point of turbidity being just sufficient to make the writing illegible as seen through the bottle, being one I could not determine with any approach to precision.

Neither was the method in which the coloring matter known as phenolphthalein is used more successful. This dye-stuff strikes a beautiful red color with an alkaline substance like baryta. It has been proposed to use a very dilute baryta solution, the strength of which is known, and draw air through it until the carbon dioxide is sufficient to just combine with the baryta, as carbonate of baryta, and the red color just disappears. But on trial I found it would not disappear. A faint rose color remains even after sufficient carbon dioxide

has been drawn through to combine with the baryta, and the right point to stop cannot be accurately ascertained.

The result of my own unsuccessful trials was to fall back upon a modified form of the method of Pettenkofer. It is both easy and accurate. It consists in using a number of flasks (I found large bottles answered the purpose), and finding the number of cubic centimeters of water each holds at the temperature of 16° C. (60° Fahr). A solution of oxalic acid is then made by dissolving 2.8636 grammes of pure crystallized acid in one liter of water; each cubic centimeter is then equivalent to one milligramme of carbon dioxide. Ten grammes of crystallized hydrate of baryta are then dissolved in three-quarter liter of water and filtered. The number of cubic centimeters of this filtered solution required to exactly neutralize sixty cubic centimeters of the oxalic acid is determined. This number will be less than sixty. The solution is then diluted until it is approximately equivalent to the acid solution, and the exact ratio determined. The large bottles are filled with air by a bellows, sixty cubic centimeters of baryta solution are poured in, the flask at once stoppered and allowed to remain so during three hours, the baryta being occasionally shaken up with the air. Of course the temperature of the air should be taken at the time the bottle is filled, and the bottle should be allowed to remain before filling in this air until it has acquired the same temperature. When the analysis is to be performed, the bottle is tilted up so as to allow the liquid to accumulate and the precipitate to settle at one side, and thirty cubic centimeters are transferred by means of a pipette provided with a rubber ball to a small narrow-mouthed flask. A drop of phenolphthalein solution is then added, and the standard oxalic solution run in until the red color just disappears. By a simple calculation and reference to a table giving the volumes of carbon dioxide corresponding to one milligramme of this gas at various temperatures, the relative volume per 10,000 in the air determined becomes known.

As illustrations of the preceding remarks, I may state that a school-room which, according to Angus Smith's bottle method, apparently contained ten parts of carbon dioxide in 10,000, really contained only 8.6 parts.

A visit to the public schools revealed the fact that the amounts of carbon dioxide were usually in great excess of that which should be present in well-ventilated rooms. I found on a clear, cold day, when the outside air was at the freezing point, and the carbon dioxide 4.18

parts per 10,000, the carbon dioxide in five rooms of a large public school in Hoboken was 21.5, 18.5, 14.2, 15.4 and 18.5 parts, respectively. The ventilation was mainly by opening the windows at the top, and the rooms were but little larger than what was absolutely required to seat the scholars. These were in the five rooms mentioned, fourty-four, twenty-eight, thirty, thirty-two and thirty-eight in number.

The determination of the carbon dioxide would reveal, I am persuaded, in many cases a defective sanitary condition, and the necessity of using other ways than the mere opening of windows to secure the imperatively-needed quantities of fresh air.

NOTE.—As the examinations of the assigned articles by the other analysts for the past year are not completed, and as important work has been done by them as to dairy products and impure waters, other material will be retained for the next report.

REPORT OF THE MILK INSPECTOR.

BY W. K NEWTON, M.D.

To the State Board of Health:

I herewith hand you my seventh annual report.

During the last session of the Legislature, an act to prevent deception in the sale of imitation butter was enacted, and the office of State Dairy Commissioner was created by that act. By the terms of the act, the office of Milk Inspector was merged into that of Dairy Commissioner, and the latter officer was required to report to the Legislature. As I was appointed to the office of Dairy Commissioner by your Board on April 3d, it will be necessary for me to make elsewhere an extended report on the operations of the dairy protection act, but, as has been the custom heretofore, a report of the work done under the milk law during the past year is herewith presented to your Board.

The work has been carried on upon the plan followed for the past six years, and nearly all parts of the State have been visited by myself or my assistants.

Mr. Henry B. Everhart, who for a number of years has acted as assistant for Hudson county, was, by reason of his removal from the State, compelled to resign early in the summer. Mr. George W. McGuire was appointed to fill his place, and has already done excellent work in that county. The other assistants are the same as at the time of my last report.

The expenses for the year have been about eighteen hundred dollars, and nine hundred and twenty-five dollars have been collected as penalties by justices of the peace for violation of the law, and should have been paid into the treasury before this.

The local Board of Health of Newark has continued the work of inspection in that city under its own direction. That city and Asbury Park are the only places in the State where any attempt is made to

inspect milk independent of the State officers; hence, the remainder of the State depends on our efforts to protect the consumers of this food.

The considerable study I have given this subject convinces me that a central bureau under your direction will do more thorough and persistent work than can be done by the many local authorities, and, while we note the exceptions of Newark and Asbury Park, the people would receive no protection, unless you had the power to enforce the law.

The reports made by me, from year to year, are nearly all repetition, and while refraining from a more extended discussion of this topic, I may add that the results of the enforcement of the milk law have been uniform and beneficial.

Advances in the chemistry of milk analysis have not been marked during the year, and I am not able to note any particular improvement. Our chemists have done their work so thoroughly that they are abreast of the times, and are on the watch for any perfection of methods that may be suggested. It is not probable that any change in the legal standard is desirable, but if any modification is contemplated it should be in the direction of increasing the stringency of the present limit. This State standard of twelve per cent. of milk solids was adopted after elaborate scientific investigations, and it is just and equitable to all dealers in pure milk; hence it would be unwise to listen to the clamor set up by interested persons who know nothing of the subject, save through inaccurate reasoning based upon imperfect or unreliable tests.

The milk law is satisfactory to all concerned in the sale or consumption of pure milk, and it has done much for the people of the State; hence it is to be hoped that so beneficent a measure will always receive the support of our representatives in the Legislature.

During the month of August it became my duty to investigate a number of cases of sickness at Long Branch, due to impure milk, and as the subject was of so great importance it was thought best to publish the results of our investigations in some reputable journal, and not to wait until this report should appear. Accordingly, an exhaustive paper on the subject of milk-poisoning was published in the *Medical News* of September 25th, 1886.

The analyses of the suspected milk were made by Mr. Shippen Wallace, one of our public analysts, and his work was checked off by me.

The paper referred to above is presented here because it is deemed of sufficient importance to be placed on permanent record in the reports of your board:*

"It is seldom that the investigator has the opportunity to trace to its source the milk or other food that has caused sickness, but we have, in these cases, been very fortunate in being able to follow every step in the management of the milk, from the farm to the consumer. In similar cases of poisoning by cheese and ice-cream which have been investigated by Vaughan and others, although chemical analysis has revealed the probable cause, and the toxic substance has been isolated, some link in the chain of evidence has been wanting. But the history now to be related seems unique, because every portion of the evidence is before us and we are able to demonstrate what the injurious material really is, besides offering other proof as to the possible cause of the formation of this substance.

"On August 7th twenty-four persons at one of the hotels at Long Branch were taken ill soon after supper. At another hotel, on the same evening, nineteen persons were seized with the same form of sickness. From one to four hours elapsed between the meal and the first symptoms. The symptoms noticed were those of gastro-intestinal irritation, similar to poisoning by any irritating material—that is, nausea, vomiting, cramps, and collapse; a few had diarrhœa. Dryness of the throat and a burning sensation in the œsophagus were prominent symptoms.

"While the cause of the sickness was being sought for, and one week after the first series of cases, thirty persons at another hotel were taken ill with precisely the same symptoms as noticed in the first outbreak.

"Drs. S. H. Hunt and Williams, of Long Branch, attended all the patients on both occasions. Dr. Hunt kindly furnishes the following account of the cases:

"'The symptoms were very similar to those of any case of gastro-intestinal irritation. I was impressed with this fact, although there was an unusual absence of diarrhœa in many of the cases. A few would have several active movements and no vomiting, the poison or cause being thus immediately removed; while in many cases it produced violent emesis, which was followed by collapse and failure of the heart's action. Both occurred in a few instances, but the rule

* Parts of this article were originally printed in the *Medical News*, September 25th, 1886.

was the persistent and obstinate nausea and vomiting, with a tendency to exhaustion and collapse as seen in cholera. The convalescence and recovery were prompt, and in a few hours all were in their usual health, and no untoward symptoms followed the attack.'

"The remedies employed were those usually indicated in such cases, such as antacids, stimulants, and in a few instances small hypodermic injections of morphia were administered.

"When the news of the outbreak was published I immediately set to work to ascertain the cause of the illness. The course of the investigation was about as follows:

"The character of the illness indicated, of course, that some article of food was the cause, and the first part of our task was to single out the one substance that seemed at fault. The cooking utensils were also suspected, because unclean copper vessels have often caused irritant poisoning. Articles of food, such as lobsters, crabs, blue-fish and Spanish mackerel, all of which at times, and with some persons very susceptible to gastric irritation, have produced toxic symptoms, were looked for, but it was found that none of these had been eaten at the time of the outbreak. The cooking vessels were examined, and all were found clean and bright and no evidence of corrosion was presented.

"Further inquiry revealed the fact that all who had been taken ill had used milk in greater or less quantities, and that persons who had not partaken of milk escaped entirely; corroborative of this it was ascertained that those who had used milk to the exclusion of all other food were violently ill. This was prominently noticed in the cases of infants fed from the bottle when nothing but uncooked milk was used. In one case an adult drank about a quart of the milk, and was almost immediately seized with violent vomiting followed by diarrhœa, and this by collapse. Suffice it to say that we were able to eliminate all other articles of food and to decide that the milk was the sole cause of the outbreak.

"Having been able to determine this, the next step was to discover why that article should, in these cases, cause so serious a form of sickness.

"The probable causes of this outbreak were outlined as follows: (1) Some chemical substance, such as borax, boric acid, salicylic acid, sodium bicarbonate, sodium sulphate, added to preserve the milk or to correct acidity. (2) The use of polluted water as an adulterant. (3)

Some poisonous material accidentally present in the milk. (4) The use of milk from diseased cattle. (5) Improper feeding of the cattle. (6) The improper care of the milk. (7) The development in the milk of some ferment or ptomaine, such as tyrotoxicon.

"At the time of the first outbreak, I was unable, unfortunately, to obtain any of the noxious milk, as that unconsumed had been destroyed, but at the second outbreak a liberal quantity was procured.

"It was soon ascertained that one dealer had supplied all the milk used at the three hotels where the cases of sickness had occurred; his name and address having been obtained, the next step in the investigation was to inspect all the farms and the cattle thereon, from which the milk was taken. It was also learned that two deliveries at the hotels were made daily, one in the morning and one in the evening; that the milk supplied at night was the sole cause of sickness, and that the milk from but one of the farms was at fault. The cows on this farm were found to be in good health, and, besides being at pasture, were well fed with bran, middlings and corn meal.

"So far, we had been able to eliminate as causes diseased cattle and improper feeding, and we were then compelled to consider the other possible sources of the toxic material.

"While the inspection of the farms was being made, the analysis of the milk was in progress. The results of this showed that no chemical substance had been added to the milk, that it was of average composition, that no polluted water had been used as a diluent, and that no poisonous metals were present. This result left us nothing to consider but two probable causes: improper care of the milk, and the presence of a ferment.

"As to the former much was soon learned. The cows were milked at the unusual and abnormal hours of midnight and noon, and the noon's milking—that which alone was followed by illness—was placed, while hot, in the cans, and then, without any attempt at cooling, carted eight miles during the warmest part of the day in a very hot month.

"This practice seemed to us sufficient to make the milk unpalatable, if not injurious, for it is well known that when fresh milk is closed up in a tight vessel and then deposited in a warm place, a very disagreeable odor and taste are developed. Old dairymen speak of the 'animal heat' as an entity, the removal of which is necesssary in order that the milk shall keep well and have a pleasant taste. While

we do not give this thing a name, we are fully convinced that milk should be thoroughly 'cured' by proper chilling and aeration, before it is transported any distance or sold for consumption in towns or cities.

"This opinion is based on a study of the methods prevalent among experienced dairymen, who ship large quantities of milk to our great cities. The usual practice is to allow the milk to stand in open vessels, surrounded by ice or cold water, for from eight to twelve hours before transportation, and when placed on the cars it has a temperature of from 50° to 60°, and is delivered to the consumers in a perfectly sweet condition. The city of New York receives about 200,000 gallons each day from the surrounding country, and much of it brought in by the railroads has been on the cars for a time varying from six to twelve hours, yet we seldom hear of any of this milk undergoing the peculiar form of fermentation set up in the Long Branch milk. We may account for this by assuming that the proper care of the milk after it was taken from the cow, and the low temperature at which it was kept, have prevented the formation of any ferment; this opinion seems to be endorsed by all dairymen and managers of large creameries with whom we have consulted. They all agree in stating that milk maintained at a low temperature can be kept sweet and in a good condition for many days.

"We have dwelt on this branch of our topic somewhat extensively, because we are fully persuaded that the improper care of the milk had much to do with the illness it produced.

"The results of our inquiry having revealed so much, we next attempted to isolate some substance from the poisonous milk, in order that the proof might be more evident. A quantity of the milk that had caused sickness in the second outbreak was allowed to coagulate, was then thrown on a coarse filter, and the filtrate collected.

"This latter was highly acid, and was made slightly alkaline by the addition of potassium hydrate. This alkaline filtrate was now agitated with an equal volume of pure, dry ether, and allowed to stand for several hours, when the ethereal layer was drawn off by means of a pipette. Fresh ether was added to the residuum, then agitated, and when separated, was drawn off and added to the first ethereal extract. This was now allowed to evaporate spontaneously, and the residue, which seemed to contain a small amount of fat, was treated with distilled water and filtered, the filtrate treated with ether, the ethereal

solution drawn off and allowed to evaporate, when we obtained a mass of needle-shaped crystals. This crystalline substance gave a blue color with potassium ferricyanide and ferric chloride, and reduced iodic acid. The crystals, when placed on the tongue, gave a burning sensation. A portion of the crystals was mixed with milk and fed to a cat, when, in the course of half an hour, the animal was seized with retching and vomiting, and was soon in a condition of collapse, from which it recovered in a few hours.

"From these experiments with this material, we were able to identify it as *tyrotoxicon*, a substance discovered and described by Prof. Victor C. Vaughan, of the University of Michigan. Although much has been published during the past two months concerning this substance, it will not be unprofitable, in this connection, to review the statements of the chemist who first described it.

"In the year 1883 about three hundred persons were taken violently ill after eating cheese, and Prof. Vaughan was requested by the Michigan State Board of Health to ascertain the cause. While engaged with this work, he discovered the substance which answered to the tests mentioned above, and which he called 'tyrotoxicon' (cheese poison.")*

In June, 1886, Prof. Vaughan was able to obtain this substance from ice-cream that had sickened some eighteen persons. †

We are now able, for the first time, to demonstrate this new substance in poisonous milk, thus endorsing the views of Vaughan, who stated in his report that, doubtless, it would be discovered in cases in which milk had caused sickness.

As to the chemical character of tyrotoxicon, little is to be said, for a sufficient amount for an ultimate analysis was not obtained. Vaughan says: "The circumstances under which tyrotoxicon develops require further study. As has been shown, it may develop in normal milk, kept in a clean bottle for three months; but it is evident that in some instances it appears much earlier." (In the cases here reported it appeared in five hours.) "The production of this ptomaine is, in all probability, due either directly or indirectly to the growth of some micro-organism."

From a close analysis of the facts in the cases recorded in this article, I am of the opinion that the substance is allied, chemically, to butyric

* Ein Ptomain aus giftegem Käse. Zeitschrift für Physiologische Chemie, Band x. Heft 2, 1886.

† Report of Proceedings of Michigan Board of Health, July 12th, 1886. The *Medical News*, July 25th, 1885, page 111.

acid; that it is formed in the milk by fermentation; and that its formation may be prevented by keeping the milk at a low temperature; or by properly cooling the milk soon after it is drawn from the cow. It seems, also, important that the so-called "animal heat" be allowed to escape. Boiling may dissipate the poison from milk that contains it; this opinion is based on the fact that tyrotoxicon is changed and driven off at a temperature of 180° Fahr.

The conclusions I arrived at, after weighing well all the facts ascertained in the investigation, were, that the sickness at Long Branch was caused by poisonous milk, and that the toxic material was tyrotoxicon.

The production of this substance was no doubt due to the improper management of the milk—that is, too long a time was allowed to elapse between the milking and the cooling of the milk; the latter not being attended to until the milk was delivered to the hotel; whereas, if the milk had been cooled immediately after it was drawn from the cows, fermentation would not have ensued, and the resulting material, tyrotoxicon, would not have been produced.

Since this investigation was made, Prof. Vaughan has found the poison in milk that was the product of one cow and had caused violent gastro-enteritis in an infant who had been fed with it. When this milk was not used the infant slowly recovered, but an attack of the disease resulted when more of the milk was taken.

The importance of the Long Branch discovery is commented on by the editor of the *Medical News* in the following language:

"The paper is a most important contribution to sanitary science, and its deductions must command widespread attention, since it is evident that this cause of poisoning is liable at any moment to be called into existence, with the same direful results.

"The practical value of the investigation lies in the fact that, by a careful process of exclusion, there was obtained a rigorous demonstration not only of the origin of the late wholesale milk-poisoning at Long Branch, but also, of the precise conditions under which the poison in question was developed. It is now conclusively shown for the first time that milk, warm from the cow, when placed in tight cans, under conditions which greatly retard the dissipation of its heat, will undergo change, with the development in the course of five hours of enough of a poisonous ptomaine to cause alarming toxic symptoms in those partaking of the milk even in small quantity.

"In view of the fact that tyrotoxicon, the poison thus developed, is volatilized at the temperature of 180° Fahr., we find increased reasonableness in the routine practice of thoroughly boiling all milk intended

for the use of infants, especially in summer. Not only does such treatment destroy the germs of lactic acid fermentation, but it dissipates an actively irritant poison which is not unfrequently present in greater or less amount.

"This investigation further teaches the important practical lesson that milk, immediately after being drawn, should be placed in open vessels and rapidly cooled by being surrounded by ice or cold water before transportation. In this way fermentation, with the resulting production of poisonous ptomaines, such as tyrotoxicon, is prevented, and the milk is delivered in a condition proper for consumption."

It will be my duty to present to the Legislature a report on the operations of the dairy protection act, and it does not seem necessary to add to the length of this report by repeating what will be offered to the authorities through another channel.

LAWS, CIRCULARS, ETC.

LAWS.

The last legislature consolidated into one act most of the laws passed within the last few years as to Health Boards in this State.

This law, with some accompanying references, was printed as Circular LVIII., and is at the command of all that desire it. It will be found to confer all necessary powers that can well be included in a general law. It does not include the law as to drainage or the adulteration of foods or the consolidated law as to the diseases of animals, which will be found in the report of the Board of Agriculture for the current year. Some of the law as to Vital Statistics also is not included, but is mostly to be found in Circular XXXIV. of the Board. References to various other laws of collateral interest will be found in Circular LVIII. It is not claimed that these laws are altogether perfect, but they will be found as available as most laws on the statute-book.

The chief difficulty arises from the passage of ordinances not in perfect accord with the laws. For the larger cities the ordinances of Paterson furnish a good model. For the smaller towns those of Lambertville will serve. Townships are generally wise in passing a few ordinances. The model given in the last report is a good one. At first it will often be sufficient to publish those sections contained in sections 6, 7, 18, 19, 20, (reference in section 20 being changed to the recent law.) Also from section 21 to the end.

In cities, some legislation which will bring *plumbing* plans under the inspection of competent persons is greatly to be desired. These should have the sanction of the State Board after the most expert approval. No injustice could then be done to plumbers. Great injustice is now done to many, and especially to the tenant class, in that houses are frequently rented which have been so imperfectly constructed as to their plumbing arrangements as to be a constant risk to the health of the occupants.

It is probable that some legislation should be had which would enable the State Board to proceed against any local nuisance which it could show to the Court of Chancery was a menace to public health, and was not attended to by the owner or by the local Board. It sometimes happens that the local Board is deterred from action by local obstacles, by lack of means or by ignorance as to modes of procedure. Personal or political or social reasons may be so operative locally as to prevent or circumvent local action. In such cases, a direct complaint or application to chancery by the State Board would give a full hearing to the person involved, while it would surmount any local reasons for neglect.

CIRCULARS.

During the past year several of the former Circulars have been reviewed and reprinted. Circulars LVII., LVIII. and XXIX. are mostly new.

The circulars have had large distribution, and many of them are in demand by Health Boards and private families when sickness occurs. Full circulation will prevent the extension of many a contagious disease. The more recent ones are herewith printed.

CIRCULAR XXIX.

OF THE

NEW JERSEY STATE BOARD OF HEALTH.

CHARITABLE AND PENAL INSTITUTIONS.

The law recently passed has directed the State Board of Health to an inquiry into the sanitary condition of Charitable and Penal Institutions of this State. The need of such inquiry has been made fully apparent in the experience of other States and countries. All such institutions have to deal with classes whose cleanliness and sanitary welfare are only secured by the most thorough administration, and by careful attention to the details of a personal and intelligent oversight. The duties of the Superintendents, if well performed, are far more

arduous and responsible than is generally appreciated. Successful care depends upon proper buildings and grounds; proper structural arrangements as to water-supply, sewerage, heating and ventilation; upon a proper supply of food, raiment and work; upon special provisions for those who are sick or feeble, and such personal attention by officers and assistants as unites capability and faithfulness.

In PRISONS and JAILS most of the inmates are to return to society. The greatest care is needed that during detention there should be no habits acquired nor influences exerted which will tend to make the person worse than before. A hopefulness of promoting reform should be entertained and provided for.

In ALMS-HOUSES, there should be a constant effort to limit those habits which cause pauperism, and to prevent its continuance either by custom or inheritance. Statistics prove that by wise planning the State has great capacity for limiting dependency, and that physical care enters largely into consideration when we would better the condition of such classes. Every State has a wide duty in provision for this portion of its population, and in seeking to limit the pauperism, sickness or crime of those who have become its wards. Were it only a consideration of economy, it is to be remembered that these classes levy the heaviest tax that is paid for State, city, county and township expenses.

Asylums are so numerous in our counties, in addition to our two State Asylums, that all of them need the most careful supervision, since success of care and treatment so largely depends upon hygienic conditions.

It is easy for STEWARDS for the poor or for the managers of institutions, to fall into routine methods, or by want of vigilance, to allow various evils. Others have no appreciation of what proper sanitary care requires, and so approve their own plans, simply because they do not know of others which are far better. This Board, with its other duties, can only offer co-operation with local authorities in all that relates to the hygienic welfare of these classes. By comparing one with another, we shall find some that serve as models, while others will come to realize their defects. Already we have been able to suggest and aid in alterations and reforms which have met with ready response from local officers. The fourth report of this Board can be had by addressing by postal, State Health Board, Trenton, N. J. It contains—pages 89–112, pages 260–65, and pages 305–10—important

suggestions for all public institutions. Other important facts and records will be found in later reports. Local Boards of Health, as well as the immediate officers of institutions, are to remember that the sanitary condition of public buildings located in their districts is subject to their inquiry, and forms a part of their administration. Here are some of the more common evils.

I. As to Buildings.—(*a.*) Too little air space for living and sleeping apartments, especially in winter.

(*b.*) Too little care as to cellars and dampness around dwellings.

(*c.*) An alms-house smell, only to be corrected by frequent house-cleaning and whitewashing.

(*d.*) Want of arrangements for the proper disposal of all excretions and refuse.

(*e.*) Absence of good ventilation, which, even if dependent on windows, would be much freer of draught if the windows extended near the ceiling, and if air was let in when needed by raising the lower sash and placing a strip of board all along under it, so as to make the place for the air to come in between the two sashes.

(*f.*) Stoves which bake the air and overheat a small space about them, but do not furnish an even temperature for rooms.

(*g.*) Absence of sufficient stairs or arrangements for escape in case of fire.

II. As to Persons.—(*h.*) Absence of accommodations for the first reception of inmates. No person should, as a rule, be received to any public institution without first having a general *bath*, a cropping or cleaning of the hair, and proper examination and change of clothing. As a precaution against contagious diseases, the person should be kept two weeks apart from the inmates. Vaccination is often required. Neglect of such precautions has recently cost a county in this State over five thousand dollars.

(*i.*) Absence of arrangements or of a system of thorough washing. All charities should have provisions and administration by which at least a weekly bathing is secured, unless some very special conditions of ill-health forbid. It is a part of the necessary discipline.

(*j.*) Absence of accommodation for special cases of sickness. A small building, separate from the rest, should always be at command for cases of malignant or eruptive fevers or other special cases that may occur.

III. As to Managers, Committees, etc.—(*k.*) There should be

monthly or quarterly inspections by directors, overseers or township committees, which should fully certify as to sanitary conditions. This not only prevents investigating committees, but prevents oversights, and is an aid to stewards and superintendents in their work. Generally it is best to have a schedule of questions as a guide and to fill out accurate answers. We can furnish schedule when desired. As far as proper, inmates should be personally seen.

IV. As to Stewards, Prison Keepers, etc.—Some of them are excellent. Most of them do as well as they know how. Too many have routine methods, and have not at all kept pace with valuable methods that have been adopted in our best institutions. It is no unusual thing for us to have to point out defects and ill-care to those who ought not to need such information. The absence of a thorough discipline and of a weekly sanitary inspection is the most common fault. INSPECTION means to look into closets and corners, to question inmates, to hear what they have to say, and to deal with all the minor details of administration, not for fault-finding but for improvement.

(*l.*) It is very desirable that a BOOK be kept by every institution that will show the time of entrance of inmates, their previous history, their ages, social condition, each birth, the causes of sickness and death, and other items such as are now always registered in well-ordered institutions. That is a narrow view of a public charity which makes it a mere receptacle or retreat. Such records come directly within the line of that care of population which these institutions are meant to subserve. One record or one year may not show much, but series of records through series of years point to methods of prevention or limitation too important to be overlooked.

(*m.*) We send with this circular a blank form of institutional inquiry, with the request that it be accurately filled out, so far as the superintendents, overseers or physicians of any State, city, county or township institution can fill the same, and be returned within one month, by mail, to the State Board of Health, Trenton. Add whatever may need to be said as to any special defects.

We are glad to furnish any information in our power, as to proper sanitary arrangements and care. So far as other duties will permit, we will, when desired, co-operate with local authorities in correcting defects or meeting special emergencies which may arise.

N. B.—The city clerk, assessor, or Board of Health to which this circular is sent, will please see that it promptly reaches the county or

township or city alms-house or other charity for which it is intended, and ask that the schedule, which is sent with it to institutions, be returned to us in due time.

By order of the Board.

E. M. HUNT, M.D.,
Secretary.

TRENTON, N. J., October, 1886.

CIRCULAR XXVII.

OF THE

NEW JERSEY STATE BOARD OF HEALTH.

SANITARY INSTRUCTION AND TRAINING IN SCHOOLS.

In the report of the Board for 1883 especial attention was directed to the importance of the recognition of physical education in public school instruction. In the previous year the Legislature had enacted the following provision:

"*Be it enacted,* That the State Board of Health be directed to confer with the Trustees of the Normal School as to definite instruction to be given in the practical care of the health of teachers and pupils, and as to provisions for such instruction."

Messrs. L. Dennis, M.D., F. Gauntt, M.D., and the Secretary of the Board, were appointed a committee on the subject. Soon after, a circular was issued by the Board and personal effort made by the committee to interest State and city school officers in the matter. We quote from the former circular as follows:

"We would call your attention to the fact that the primary object of the public school system of the State is to secure good citizenship. There can be no complete citizenship without a knowledge of and obedience to the laws of one's own being and the laws of society—civil, sanitary and social. With these it is safe to say we shall secure among all classes of the community the best health, the highest productivity—moral, intellectual and physical—and the greatest amount

of well-being and happiness. We would remind you that hitherto the laws of one's own being and those of communities, constituting the great body of facts known as hygiene and sanitary science, have been very much neglected in the usual course of public instruction in this State. Thus the young have been permitted to grow up exposed to all the dangers to life and health which follow, inevitably, the disobedience of nature's laws.

"Is it not very certain that some of the time now spent in teaching branches of knowledge indirectly or remotely serviceable to the learner might, more profitably to the pupil and to the State, be devoted to imparting such knowledge as must needs be practically useful every day and hour of one's life?

"Is it not equally evident that the kind of knowledge which contributes directly to the maintenance of health and vigor of body and mind, the prolongation of life, and the fullest development of all the faculties into a complete and perfect manhood and womanhood, must be second in importance to none other?

"If this be true, is it not equally clear that instruction in Hygiene should be as systematically and thoroughly given in all grades of schools, as upon any other subject? Admit these propositions and you will agree that we need to modify, as speedily as possible, our scheme of education.

"It need hardly be said that the change, to be effectual, must be radical. Teachers must be themselves taught. Teachers' Institutes should make this subject a prominent part of each meeting. Superintendents should unitedly bring to bear all their influence to secure it a place in the regular course of study in the schools under their charge, and should stimulate the teachers to give their best efforts to make it as thoroughly practical as it will be intensely interesting when properly pursued. BOARDS OF TRUSTEES, upon whom now devolves the duty of determining the studies to be pursued in their respective districts, should at once take steps to introduce physical teaching and training in the course, and by faithful oversight see that it is adequately and properly taught. Not by occasional lectures here and there before bodies of teachers, not by bits of advice to pupils, on the part of well-meaning and well-informed teachers, can this work be properly done, but only by systematic oral and text-book instruction, as faithfully and persistently pursued as possible, and adapted to the ages and capacities of the pupils. It need hardly

be said that the subject is broad enough to engage the profoundest thought, yet its facts are the facts of every-day life, many of them so simple and so clear as to be readily taught and practiced."

While the response to these views was not rapid, steady progress was made. The Board sent out a circular for a sanitary report on each school-house of the State and received full responses from nearly every district. Some 1,600 replies are now on file with the State Superintendent of Schools, who has earnestly co-operated with us in the work. A course of instruction in Hygiene was last year organized in the State Normal School, and now each graduate is *required to pass examination* upon this as in other departments. Its importance has been prominently discussed before Teachers' Institutes, and in the various conferences now held by teachers in cities and in the various counties. We believe it is no longer doubted that all teachers need to make of this subject a special study, and that in all graded schools some of the classes should have systematic instruction upon the subject. In addition to text-books which have been prepared, we have several forms of syllabus, or outlines for instruction. There are also in our library, at the command of the teachers of the State, nearly all of the books which have been written under the titles of Anatomy, Physiology, Hygiene, Physical Education, Health, Temperance Physiologies, etc., a list of many of which is herewith given for reference. It is now feasible for any teacher to be prepared to teach in this department and to supplement some chosen text-book by an amount of information and practical illustration of the highest importance to the student. It is often possible to add, by way of experiment, in the departments of Physics and Chemistry, bearing on Hygiene, and to acquire such manual dexterity in Calisthenics as will much aid in the instruction. It has been found that *manual training* aids much in the discipline of the schools and in developing courage, honor, self-reliance and self-control. There is also need that the principles of Hygiene should be thoroughly applied in courses of education; that each child should know what are the conditions of health, what habits are to be cultivated to secure it, and what evils are to be avoided. Practical physiologists and educators are fast coming to the conclusion that there should, from time to time, be thorough examination of scholars with a view of knowing their general physical vigor, the condition of the eye and other senses, and the relation of their studies to their present mental capacity. It will

not do to deal with children *in masses or classes*, forgetful of individual characteristics, abilities or disabilities. Methods of education are constantly under review, not only in reference to mental but to physical strain. *The public school is intended to fit the scholars for the active duties of life.* A majority of them will need to make a living by some form of manual employment. The care of the physicial cannot, in such cases, be said to be secondary to that of the mental. We have already had occasion to acknowledge a prompt response on the part of the State public school officers and many Boards of Education and prominent teachers to the efforts made in this behalf, and issue this circular in order that they and all others may avail themselves of any aid we can furnish to this popular and needed demand of education. Its bearing upon the check of indulgence in the use of *Stimulants* and *Narcotics*, is all-important, as well as its general bearing on all that relates to the welfare of the citizen. The State is seeking *healthy bodies* as well as *trained minds*, both of which can be used in the common service of the State, of the family, and of the individual. It is now recognized that proper care of the body has much to do with all that tends to secure good, efficient and capable citizenship.

The following are some of the books to which reference can be made:

HYGIENE.

"Hygiene of Schools." By J. B. Budget, M.D. H. K. Lewis, London.

"School Hygiene." By Drs. Wells, Draper, &c. Ginn & Co., Boston.

"School and Home Hygiene." By Ezra M. Hunt, M.D. Ivison, Blakeman, Taylor & Co., New York.

"Hygiene." By A. Newsholme, M.D. Geo. Gill & Son, London.

"Health." By John Brown, M.D. R. Carter, New York.

"The Air; its Relation to Clothing, Dwelling and Soil." By M. Von Pettenkofer. Trübner & Co., London.

"The Art of Preserving Health." By J. Armstrong, M.D. G. W. Light, Boston.

"Preservation of Health." By J. C. Warren, M.D. Tickner & Fields, Boston.

"Sanitary Science." By R. S. Burn. Wm. Collins & Co., Glasgow.

"The Laws of Health." By M. J. Beale, M.D. Blanchard & Lee, Philadelphia.

"Uses and Abuses of Air." By J. H. Griscom, M.D. Redfield, New York.

"Art of Prolonging Life." By C. W. Hufeland. Lindsay & Blakiston, Philadelphia, Pa.

"Physical Education." F. L. Oswald, M.D. D. Appleton & Co., New York.

"Health for Households and Schools." By E. Smith, M.D. W. Isbister & Co., London.

"Eyesight; Good and Bad." By R. B. Carter, M.D. Blakiston, Philadelphia, Pa.

"Healthy Homes." By G. Wilson, M.D. Blakiston, Philadelphia, Pa.

"Lectures of Health." By C. A. Cameron. Cassell & Co., London.

"Water-Supply." By W. Ripley Nichols. Wiley & Sons, New York.

"Principles of Ventilation and Heating." By J. S. Billings, Sanitary Engineer, New York.

"Laws of Health." By J. C. Huchinson, M.D. Clark & Maynard, New York.

"The Eclectic Physiology." By E. F. Brown, M.D. Van Antwerp, Bragg & Co., Cincinnati, Ohio.

"Helps to Health." By H. C. Burdett. Paul, French & Co., London, Eng.

"Hints on Health." By Wm. E. Coale. Tickner & Fields, Boston.

"Healthy Dwelling." By Catharine M. Buckton. Longmans, Green & Co., London.

"Health by Exercise." By G. H. Taylor, M.D. John B. Alden, New York.

"Health Studies." By H. Sinclair Patterson, M.D. Hodder & Stoughton, London.

"School and Industrial Hygiene." D. F. Lincoln, M.D. P. Blakiston, Philadelphia.

"Our Dwellings; Healthy and Unhealthy." By Catharine M. Buckton. Longmans, Green & Co., London.

"Healthy Life and Healthy Dwellings." By George Wilson, M.D. J. A. Churchill, London.

"Health." By W. H. Corfield, M.D. D. Appleton & Co., New York.

"Hygiene." By John J. Pilley, F.C.S. Gill & Sons, London.

"Health Lessons for Beginners." C. M. Brands. Leach, Shewell & Sanborn, New York.

"Health and How to Promote it." By Richard McSherry. D. Appleton & Co., New York.

"Health and Education." By Rev. Chas. Kingsley. D. Appleton & Co., New York.

"Handbook of Hygiene." By Geo. Wilson, M.D. Lindsay & Blakiston, Philadelphia.

"The Maintenance of Health." By J. Milner Fothergill, M.D. Smith, Elder & Co., London.

"Personal Care of Health." By E. A. Parkes, M.D. Pott, Young & Co., New York.

"First Lessons in Health." By J. Berners. Macmillan, London.

"The Book of Health." By M. Morris, M.D. Cassell & Co., New York.

ANATOMY AND PYSIOLOGY.

"Primer of Physiology and Hygiene." By Wm. T. Smith, M.D. Ivison, Blakeman & Co., New York.

"Elementary Physiology and Hygiene." By Wm. T. Smith, M.D. Ivison, Blakeman & Co., New York.

"Physiology." By Jerome Walker, M.D. A. Lovell & Co., New York.

"Comprehensive Anatomy, Physiology and Hygiene." By J. C. Cutter, M.D. J. B. Lippincott & Co., Philadelphia, Pa.

"Lessons in Hygiene, Physiology and Stimulants." By J. C. Cutter. J. B. Lippincott & Son, Philadelphia, Pa.

"Physiology." By M. Foster, M.D. Macmillan & Co., London.

"Physiology for Schools." By Mrs. C. Bray. Longmans, Green & Co., London.

"Elementary Lessons in Physiology." By T. H. Huxley. Macmillan & Co., London.

"Elements of Physiology and Hygiene." By T. H. Huxley. D. Appleton & Co., New York.

"Elements of Animal Physiology." By J. Angell. Wm. Collins' Sons, London.

"Practical Physiology." By E. Lancaster, M.D. D. Bouge, London.

"Principle of Mental Physiology." By Wm. B. Carpenter, M.D. C. Kegan, Paul & Co., London.

"Physiology." By T. H. Huxley, F.R.S. Macmillan & Co., London.

"Temperance Physiology." By Mrs. Mary H. Hunt. A. H. Barnes & Co., New York.

"Physiology and Hygiene." By J. C. Hutchinson, M.D. Clark & Maynard, New York.

"Glasgow Health Lectures." ———. J. Menzies & Co., Glasgow.

"Elementary Lessons in Physiology." By T. H. Huxley, F.R.S. Macmillan & Co., London.

GYMNASTICS, ATHLETICS, CALISTHENICS AND TRAINING.

"How to Get Strong." By Wm. Blaikie. Sampson, Low & Co., London.

"Sound Bodies for Our Boys and Girls." By Wm. Blaikie. Sampson, Low & Co., London.

"Gymnasts and Gymnastics." By J. H. Howard. Longmans, Green & Co., London.

"System of Physical Education." By A. Maclaren. Oxford Press.

"Training, in Theory and Practice." By A. Maclaren. Oxford Press.

"Youth; its Care and Culture." By J. Mortimer-Granville. D. Bouge, London.

"Athletic Sports." By Rev. J. G. Wood. G. Routledge & Sons, London.

"The Source of Muscular Power." By A. Flint, Jr., M.D. D. Appleton & Co., New York.

"Mechanical Exercise." (Zander Institute). J. & A. Churchill, London.

"Calisthenics and Gymnastics." By J. Madison Watson. J. W. Schermerhorn, New York.

"Manual of Calisthenics." By J. Madison Watsou. E. I. Horsman, New York.

"Exercise and Training." ——. Hardwick & Bouge, London.

"Home Gymnastics." By T. J. Hartelius, M.D. J. B. Lippincott & Co., Philadelphia, Pa.

"The Ling Gymnastics." By M. Roth. H. Bailliere, London.

"Code-Book of Gymnastic Exercises." By L. Puritz. Trübner & Co., London.

"Exercise and Training." By C. H. Ralfe, M.D. D. Appleton & Co., New York.

"What is Play." By John Strachan. D. Douglas, Edinburgh.

"Gymnastics of the Voice." By Oscar Guttmann. E. S. Werner, Albany, New York.

"Papers of International Health Exhibition." London, 1884.

"Papers of American Public Health Association." Press Association, Concord, N. H.

Copies of this and other circulars are to be had on application to this Board.

E. M. HUNT,
Secretary.

Trenton N. J., Oct., 1886.

CIRCULAR XXX.

OF THE

NEW JERSEY STATE BOARD OF HEALTH.

SANITARY SURVEY, TOPOGRAPHY, ETC.

The observations of Sanitarians in other countries and in a few of our States, have led to the belief that the occurrence and the fatality of many diseases depend much upon geological structure, soil, topography, elevation and exposure, rain-fall, relations to seas or other bodies of water, density of population, and other local conditions not determined by the latitude or longitude of the locality. Thus districts, or even small precincts, have their climate, which bears relations to the vitality of the people and governs the causes and courses of

disease. It is for this reason that sanitary survey and topography have attracted the attention of the National Government, and may well concern a State which presents diversities already so recognized by common observation as to have led to preferences and selections of resorts in adaptation to different kinds and phases of disease. While these general observations are valuable, it is only by the close and confirmatory observations of experts and the tabulation of closely-noted facts that we arrive at well-sustained conclusions. It is fortunate for this State that its geology and topography are so well mapped as to afford an excellent basis for this kind of observation. After a conference with Prof. George H. Cook, the State Geologist, this Board has found it feasible to supply a sufficient number of maps to a sufficient number of observers to make this kind of observation practicable. It is proposed in connection with medical societies and other scientific societies or individual observers in the State, to place this map in the hands of some chosen observer, who, up to the year 1890, will collect from the township or city in which he resides such data as shall enable him to estimate the relation of his particular locality to disease. The areas chosen will be townships and cities, and, of the larger cities, wards, or some more natural divisions, with a map of reference pointing out the relations of each locality. With the facts from time to time furnished by our reports and vital and meteorological data, we shall hope to give fixedness of attention and uniformity of system to the observation. Much will depend upon the choice of an observer who is painstaking, and who has some skill in accurate methods of observation.

Such an observer would first study with care the locality with which he has to deal in all its tellurial conditions. He would inquire how it varies as to degrees and moisture, how far the wells and river beds indicate its usual and varying water level; how the relations of valleys, hills and bodies of water affect the degree of heat it receives, and how prevailing winds indicate its local changes or result from its adjacent relations.

He would seek from the assessor or city clerk the deaths in the district, with age, date and place of residence, in order to see whether for these years the relations of these to the general or precise locality could be discovered, and note explanatory views. To some degree, as in rheumatism or consumption, he would seek to know how far locality produced the malady or influenced its progress. If a part of

his township or ward had marked diversity from that in which he lived or over which he rode, he would select some careful observer to afford such information as appertained to his valley or hill, or water front. Often a few questions at the meetings of medical men would aid to give precision, in place of the casual impressions too apt to be accepted from a very few cases. The laws of locality thus become informatory as to disease. If, for instance, every house in a township could give the history of every case of disease that has occurred in it the last fifty years, and one skilled in etiology and classification could handle the data, he would come to know what significance to give to cases and learn from them to unriddle causes far better, because of being a living witness and investigator, and so having sources for comparing and correcting observations. Thus not only the records of death, but of disease and the personal experience of local practitioners are secured. A map can be had by each president or reporter of a county or city society, as the property of the society, in order that views may be compared. A physician who has lived and practiced many years in one locality, and whose note-books can remind him with exactness of cases and circumstances, has really very much information as to climatic or other local causes which he can give and which ought not to die with him.

Short notes made at the end of each month as to local characteristics and diseases, and summed up at the end of each year, would aid much in the final summary. So soon as a full list of observers is secured, a very brief yearly report is desired, so as to assure a full return at the end of the period. For the small expense incurred in correspondence, provision will be made. As localities and the methods of individual observers are so diverse, no precise form will be given unless asked for. The design is rather to get the mature judgment of the observer, formed in his own way, except that it should depend upon the careful study and analysis of closely-noted facts and be formed on expert and continued investigations and reflections. It should be observation through precise methods rather than the promiscuous methods of unskilled observers. We hope by the time of the next decennial census to be able to get a sufficient number of data to give valuable guidance. The effort is to get, in connection with vital returns, the personal testimony of some competent observer. That experience is most valuable which, either by statistical or other methods, classifies knowledge, and so has breadth of view and system of analysis in arriving at conclusions.

When the physicians of any locality come to study accurately the deaths of each year, the diseases of each year, to compare vital statistics with their own observations, when they acquire the habit of being observers on a system to such a degree that their conclusions are arrived at not as hasty generalizations or from a few recent cases, but as the records of analyzed experiences, we always secure the most valuable facts as to public health and the prevention of disease. Carefully-collected statistics and carefully-collated experience, are the two factors of information upon which the State care of the health of the population must rely. We, therefore, ask societies and individuals to aid in this work, and all the more because it is not less vital to the progress and success of medical science and art, than it is to social and sanitary progress. Any physician who thus on a system files away his observations each three or six months, will have no difficulty at the close of the year, or at longer periods, in furnishing valuable data as to the diseases of his locality and suspected impairments to the general health.

By order of the Board,

EZRA M. HUNT, M.D.,

Trenton, N. J., Oct., 1886. *Secretary.*

CIRCULAR LVII.

OF THE

STATE BOARD OF HEALTH OF NEW JERSEY.

TO THE PHYSICIANS OF THE STATE.

It is the belief of this Board that, to some degree, a larger proportion of the people of the State are coming to realize that the well-educated physician does not merely seek to cure disease, but is inquisitive as to its causes, in order to prevent its occurrence or modify its severity. He is thus a public benefit to the people and to the State, as well as of service to individuals in times of sickness or injury.

It has not escaped the attention of any practitioner of ten years' experience and observation in the State, that typhoid fever and diph-

theria, by their frequency and fatality, have singled themselves out as calling for some special study.

In the five years ending June 30th, 1883, there had been 2,818 deaths from typhoid fever reported, and 5,719 from diphtheria. From the latter, this is more than from small-pox, scarlet fever and measles combined. In the year ending June 30th, 1884, there were 640 deaths from typhoid fever, and 1,027 from diphtheria, or more that year than from small-pox, scarlet fever, measles and whooping-cough combined. In the year ending June 30th, 1885, there were 642 from typhoid fever and 1,496 from diphtheria, or more again than from all other communicable diseases combined.

Taking the aggregate for the seven years, we thus find that the two diseases, and especially diphtheria, have a prominence of fatality which stands for a very large aggregate of actual cases. It is also conceded that both of them come before us for very careful study, when we consider the means of preventing communicable diseases. One who has reason to meet with various physicians in these local outbreaks, comes to find among them more difference in their success in preventing than in treating these diseases. A few feel their duties to be to the patient, and give little heed to other persons or to surroundings. Others are fully aware of some of the facts as to the modes of spread of these diseases; but give verbal directions, which they do not see carried out with precision. The successful preventers and life-savers are those who combine comprehension and execution, and who see to it that the most thorough and exact details of isolation, dryness, ventilation, cleansing and disinfection are secured. There are physicians who rarely lose any but the first cases in any family. If only the majority could be brought up to the habits and methods of the few, many hundreds of lives would be saved to families and to the State.

But this circular has other purposes than that of mere suggestion, persuasion or the outlining of methods clearly indicated in Circular XLIV. If district medical societies or individual physicians would from year to year furnish exact clinical notes to this Board as to the facts ascertained, or as to failure, after close inquiry, to obtain facts as to mode of rise, progress, propagation and spread, or as to the results of separation, of antecedent treatment, of sanitary methods, etc., we would be enabled to classify the facts and make deductions therefrom as no single practitioner can in the field of his own practice. Postage, at least, would be remitted, and due credit given for the information.

If physicians of the State, who are competent and candid observers and accurate in their memory and record of clinical observations and experience, will unite in the effort at collective investigation, we believe these diseases will be reduced in frequency as well as decreased in fatality.

We therefore send out this circular with the hope and belief that some persons can be found in each city and county who will be willing to aid in an inquiry which involves the interests of more families and the lives of more persons than any other inquiry as to communicable diseases.

We send herewith a schedule of suggestive questions, marked by numbers or letters, answers to which can be given under the numbers or letters, without repetition of the questions. Where there has been a recent epidemic, we desire that, about at its close, an account of it should be transmitted, and that at least by the first of November of each year a summarized statement should reach us.

TYPHOID FEVER.

1. Cases, sex, age, date.

2. Proof that it is typhoid fever.

3. Length of case and termination.

4. Statement of probable origin.

5. If its cause cannot be traced after much effort has been made, so state.

6. Reasons you have to think it to have sprung from an antecedent case, with detail of enough cases to illustrate your ground of belief.

7. Reasons you have to think that it, or any other cases, have developed *de novo* in the locality or person.

8. Your opinion as to whether there are other low forms of fever which depend on ordinary contamination of air or water, which resemble typhoid fever but are not the same.

9. Illustration of any case which you believe, in the start, not to have been typhoid fever, but which became so.

10. Statement as to the disposition you know to have been made of discharges and of soiled garments.

11. Was there neglect as to this before the case came under observation, or before it was recognized as typhoid fever?

12. How many cases of it have you attended, in persons over sixty years of age?

13. Have you known second attacks?

14. What do you think to be the incubating period? Grounds for your opinion.

15. What is your plan of isolation, disinfection and ablution of the patient?

16. Do you resort to any prophylactic medication in families where there are cases?

17. If you have accurate notes of cases, state the number of cases you have seen since July 1st, 1878, and what proportion have recovered.

DIPHTHERIA.

(*a.*) Cases, sex, age, date.

(*b.*) Proof that it is diphtheria.

(*c.*) Your views as to its relation to membranous croup, as derived from cases seen or treated by you.

(*d.*) Can you trace it to a previous case?

(*e.*) If not, give your view of the causes, with reasons for your views.

(*f.*) Are you able to associate it with confined dampness, or with those atmospheric conditions in which algæ or fungi, or other like forms of vegetable growth abound?

(*g.*) Have you known it to follow the exposure of cesspool material, or other forms of filth, in "close weather," either to natural or artificial heat?

(*h.*) Give your opinion, with illustrative cases, as to whether any of the common forms of sore throat, or follicular tonsilitis, ever degenerate into diphtheria, or impart it to susceptible persons.

(*i.*) How often have you personally attended the same person with it?

(*j.*) Is it milder in second attacks?

(*k.*) When a person is attacked, what is your plan of isolation and disinfection?

(*l.*) What do you think to be its incubating period, and what are the grounds of your opinion?

(*m.*) Do you resort to any prophylactic medication to prevent others from contracting or developing it?

(*n.*) Have you had good results in attempts to limit it in schools or in families of children? And if so, state your methods.

(*o.*) If you have accurate notes of cases, state the number of cases you have seen since July 1st, 1878, and what proportion have recovered.

(*p.*) From this time onward, will you, both as to it and typhoid fever, keep an accurate record and so communicate with us as to aid in future inquiry?

(*q.*) Can you not, in your local society, appoint a special reporter who, in addition to the individual accounts of epidemics, will collect facts as to sparse or occasional cases reported by physicians?

For copies, address E. M. Hunt, M.D., Trenton, N. J.
[1886.]

LAWS OF 1886, RELATING TO PUBLIC HEALTH.

Chapter XXVIII.—Supplement to an act entitled "An act to provide for drainage, where the same is necessary to the public health," approved March twenty-fourth, one thousand eight hundred and eighty-one.

Chapter LVI.—An act to authorize the construction of drains and sewers upon and across private property upon suitable compensation to the owner or owners thereof in incorporated towns in this State.

Chapter LXX.—Supplement to an act entitled "An act to provide for drainage and sewerage in densely-populated townships in which there is a public water-supply," approved March fourth, one thousand eight hundred and eighty-four.

Chapter LXXXIII.—A further supplement to an act entitled "An act to limit the age and employment hours of children, minors and women, and to appoint an inspector for the enforcement of the same, approved March fifth, one thousand eight hundred and eighty-three.

Chapter LXXXIV.—An act to prevent deception in the sale of oleomargarine, butterine or any imitation of dairy products, and to preserve the public health.

Chapter LXXXIX.—A supplement to an act entitled "An act to authorize cities to construct sewers and drains, and provide for the payment thereof," approved March eighth, one thousand eight hundred and eighty-two.

Chapter CXI.—A supplement to an act entitled "An act to authorize the incorporation of rural cemetery associations and to regulate cemeteries" [Revision], approved April ninth, one thousand eight hundred and seventy-five.

Chapter CXLVIII.—An act to authorize cities of this state to purchase, construct and maintain a public bath.

Chapter CLXXIX.—An act concerning cities, authorizing the building of sewers.

Chapter CLXXXII.—An act providing for sewerage in and from certain towns in this State.

Chapter CLXLVII.—An act to revise, consolidate and amend certain acts concerning boards of health in this State.

Chapter CCIII.—A supplement to an act entitled "An act relating to the improvement of streets and the construction of sewers in cities of this state," passed March twenty-seventh, one thousand eight hundred and eighty-two.

Chapter CCXXV.—An act concerning contagious and infectious diseases among animals and to repeal certain acts relating thereto.

Chapter CCXXVII.—An act relating to sewers in townships.

Chapter CCXXXI.—A further supplement to "An act to enable cities to supply the inhabitants thereof with pure and wholesome water," approved April twenty-first, one thousand eight hundred and seventy-six.

Chapter CCXXXVI.—Supplement to an act entitled "An act to provide for the drainage of lands," approved March eighth, one thousand eight hundred and seventy-one.

Chapter CCLXXII.—A supplement to an act entitled "An act to authorize cities to construct sewers and drains, and to provide for the payment of the cost thereof," approved March eighth, one thousand eight hundred and eighty-two.

MEDICAL REGISTRY.

In accordance with an act approved March 12th, 1881, and the supplement thereto approved March 22d, 1883, it is made the duty of every person practicing medicine and surgery in this State to record a diploma, with date and place of graduation, or in case of twenty years' practice in any one locality, a certificate thereof in the office of the County Clerk of the county in which the practitioner settled.

This law means that only *medical* diplomas and such certificates as those above named shall be filed. It does not mean to give permission to file any and every writing and call it a diploma. Only a diploma that shows it is from a chartered medical college is to be recorded, and only the certificates of those who have practiced in this State twenty years without a diploma are to be filed.

The law is of some value as showing what authentication has been given to the person to begin the practice of so responsible and intricate an art as that of medicine and surgery. No one can review the lists of the past five years, without the strong impression that there has not been an increase in the *proportionate* number of well-educated practitioners in this State. While there is no need of any sect discrimination, in so far as legal status is concerned, there is need that illiteracy and incompetency be regarded as a menace to the public health. This subject so impressed the legislative authorities in Illinois that about 1880 there was passed a "Medical Practice Act." Its chief feature was to require an examination of those seeking to practice in the State by a medical Board, which did not seek to exclude those of any school who had been duly educated, but did seek by a fair examination to exclude all those who had not a requisite *preparation*. The result was that of about 7,000 practitioners 2,000 were found to have had no adequate preparation. The Legislature and the courts have fully sustained the law as in the interests of the public health and the common welfare of the people. The recent Governor says of it: "It was a law to protect the lives, the health, the morals and the

property of the people of the state." While this Board has not regarded it as its special function to seek special legislation on this subject, it is a serious question whether much harm is not being done to the citizens of the State by the great laxity of our laws as to medical practice. The lawyers of the State examine a lawyer settling in this State before he is admitted to practice in the courts. It seems that health is as important as property, and that there is at least equal reason why a license to practice medicine should emanate from those who by their acquired learning and reputation for skill, among us, are recognized as judges of real fitness.

ATLANTIC COUNTY.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCALITY.
Billing, Theodore G	Hammonton	Mar. 31, '86	Hahneman College, Phila.
Baily, Alfred William	Atlantic City	Mar. 31, '86	Hahneman College, Phila.
Davidson, Chas. C	Atlantic City	Mar. 13, '80	Jefferson Med. Col., Phila.
Harris George M	Atlantic City		Eclectic Med. Col. of N. Y.
Hyde, Erastus C	Mays Landing	Apr. 2, '84	Hahneman College, Phila.
Snyder, Leon A	Atlantic City	Mar. 12, '75	Hahneman College, Phila.
Miller, Mary	Atlantic City	Apr. 4, '78	Custodes Medical Academias.

BERGEN COUNTY.

Van Wagenen, Daniel B.	Closter	Feb. —, '85	Bellevue Med. Col., N. Y.

BURLINGTON COUNTY.

Mattson, Alfred S	Moorestown		
Garrabrant, Clarence	New Gretna	Mar. 25, '86	Col. of Phy. and Surg. of Md.
La Forge, C	Jacobstown	Mar. 25, '86	
Williamson, Mathew S	Beach Haven	Mar. 25, '72	Hahneman Med. Col., Phila.
Waterman, Francis C	Florence	Apr. 2, '85	Jefferson College.
Haines, A. C	Columbus		University of Pennsylvania.
House, C. Wesley	Columbus		University of Pennsylvania.
Simpson, M. S	Bordentown	Apr. 2, '83	Jefferson Medical College.
Rialston, George		Apr. 2, '86	Jefferson Medical College.
Miller, Elijah	Tuckerton	May 1, '86	University of Pennsylvania.

CAMDEN COUNTY.

Woodward, George D	Camden	Apr. 2, '84	Hahneman Medical College.
Davis, Nehemiah		Apr. 2, '86	Jefferson Medical College.
Benwell, Howard G		Apr. 2, '86	Jefferson Medical College.
Greenwalt, J. C		May 1, '84	University of Pennsylvania.
Sherk, Harry H		Apr. 29, —	Jefferson Medical College.
Swain, Uriah J	Camden	Dec. 24, '86	Albany Medical College.

CAMDEN COUNTY—Continued.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCALITY.
Davis, Robert H............	Waterford	June 24, '79	Philadelphia University.
Severeen, A. W............	....	Apr. 20, '70	Col. of Phy. and Surg., Ont.
Leggins, John J............	....	....	Michigan Col. of Medicine.
Palmer, William S.........	....	....	Electropath.
Beneschurd, G. A..........	....	Apr. —, '85	Hahneman Med. Col., Phila.
Thiel, Thomas..............	....	Apr. 23, '86	Hahneman Med. Col., Phila.
Kilduffe, Robert............	....	Apr. 15, '85	Jefferson Med. Col., Phila.
Leavitt, John F............	....	July 9, '86	University New York City.
Gallagher, W. E............	Camden	Feb. 29, '84	Detroit Medical College.
Campbell, Walter..........	....	Mar. 18, '86	Pennsylvania Medical Col.

CAPE MAY COUNTY.

Hewson, Addinell, Jr.....	Cape May City.....	Mar. 13, '79	Jefferson College, Phila.
St. John, Josephus Allen	Holly Beach........	Mar. 13, '73	Chicago Medical College, Ill.

CUMBERLAND COUNTY.

Burge, John.................	....	—— —, '41	Botanic Med. Col. of Ohio.
Bewley, Richard............	Port Norris.........	Mar. 31, '86	Hahneman College, Phila.
Elmer, Matthew K.........	Bridgeton	May 1, '85	University of Pennsylvania.
Frasier Joseph A...........	Rosenhayn	June 1, '86	Eclectic College, Cincinnati.
Fullman, John J............	Bridgeton	Feb. 8, '58	Eclectic Med. Col, Penna.
Glanden, Walter P.........	Newport.............	Apr. 2, '86	Jefferson Med. College. Phila.
Husted, Francis B.........	Deerfield	Apr. 2, '86	Jefferson Med. College, Phila.
Robinson, William L......	South Vineland....	Mar. 7, '49	Med. Col. of Pennsylvania.
Siggins, John J.............	Millville..............	Mar. 2, '85	Mich. Col. of Med., Detroit.
Sweany Leverette	Bridgeton	Mar. 3, '81	Medical College of Indiana.

ESSEX COUNTY.

Brockway, Millard.........	Newark	Mar. 6, '81	Medical College, New York.
Beniss, E. D..	....	Apr. 15, '86	Hom. Med. College, N. Y.
Bachmann, Charles........	Newark..............	Mar. 25, '86	Eclectic College, New York.
Buchanan, Rebecca R. R.	....	May 22, '77	College of Cincinnati, Ohio
Braun, Rudolph............	....	May 15, '83	Col. of Phy. and Surg., N. Y.
Chace, Eloise I.............	....	Apr. 8, '86	Medical College, New York.
Edwards, David J.........	Newark	Mar. 8, '82	University Med. Col., N. Y.
Fuller, Frances Van C....	....	May 19, '84	Female College, New York.
Greene, Alonzo J..........	....	May 27, '67	Eclec. Med. Ins., Cincinnati.
Greene, F. E................	....	Jan. 26, '75	Eclec. Med. Ins, Cincinnati.
Hesse, Frederick J.........	....	Feb. 8, '79	Ohio Medical College.
Kaiser, Fanny Isenburg..	....	June 30, '86	College of Midwifery, N. Y.
Meyers, Geo. H............	....	May 13, '86	Col. of Phy. and Surg, N. Y.
Nadler, Frederick Chas...	Newark	Mar. 8, '86	University of City of N. Y.
Odell, Francis Marion....	....	Mar. 10, '77	Col. of Phy. and Surg., N. Y.
Philhower, George B......	....	Mar. 5, '86	University of New York.
Pearson, John Clifton.....	....	July 3, '82	
Penrod, Hiram.............	....	July 11, '72	Washington Med. Col., Balt.

ESSEX COUNTY—Continued.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCALITY.
Robertson Samuel E......	....	Mar. 15, '86	Bellevue Hospital Med. Col.
Randolph, John............	Newark..............	Feb. 29, '76	Col. of Phy. and Surg., Balt.
Rhein, Meyer L............	....	Mar. 3, '80	Albany Med. College, N. Y.
Russell, Reva..............	....	May 22, '79	American Eclectic College.
Rice, Marian Louise.......	....	June 24, '74	University of Michigan.
Schmidt, Wilhelmina M..	Newark..............	Feb. 16, '85	College of Midwifery, N. Y.
Severance Charles Earl...	Newark..............	Mar. 12, '58	New York Medical College.
Searing Harry W..........	....	Mar. 9, '85	Bellevue Hospital Med. Col.
Spottiswoode, Sarah C....	....	Apr. 20, '86	New York Female College.
Scovel, Ashley.............	....	Mar. 4, '85	South Carolina Med. College.
Siggins, John J......	....	Mar. 2, '85	Michigan College of Med.
Van Giesan, Wm. H......	....	Mar. 15, '86	Col. of Phy. and Surg., Balt.
Ward, Aaron C............	....	May 13, '85	Col. of Phy. and Surg., N. Y.

GLOUCESTER COUNTY.

Hurson, Jacob M..........	Williamstown......	Mar. 31, '81	Hahneman Med. Col., Phila.
Judson, A. R................	....	Apr. 2, '85	Jefferson Med. Col., Phila.
Miller, Elijah..............	Clarksboro	....	University of Philadelphia.
Pound, Wm. H.............	Paulsboro...........	Mar. 31, —	Hahneman Med. Col., Phila.
Stout, Harry A.............	Wenonah	Apr. 2, '86	Jefferson Med. Col., Phila.
Talmar, John J.............	....	....	Eclectic Med. Col., Phila.
Wilson, Howard A.........	Woodbury...	—— —, '84	Jefferson Medical College.

HUDSON COUNTY.

Bosco, Otto.................	Hoboken	—— —, '67	Rush Med. Col., Chicago, Ill.
Ayars, Sherman Edwin...	....	Mar. 3, '84	Eclectic Med. Col., N. Y.
Van Horn, A. Fellows...	....	—— —, '84	University Pennsylvania.
Nevin, John Joseph.......	Jersey City.........	—— —, '86	University City of N. Y.
Griswold, William.........	....	Apr. 15, '86	Hom. Med. Col., N. Y.
McMillan, John Wales...	....	Apr. 15, '86	Hom. Med. Col., N. Y.
Theel, Gustavus F.........	....	Feb. 18, '86	Beachol Inst. of Medicine.
Szymanski, Felix...........	Applicat'n refused	Oct. —, '69	Panormitanaë Hom. Med. A., Brazil, Rio de Janeiro.
Stegmair, Julius A.........	....	Mar. 8, '86	University City of N. Y.
Hollister, Samuel A.......	....	Mar. 24, '86	Hom. Col., Cleveland, O.
Carpenter, Andrew J......	....	Apr. 8, '86	Eclectic Med. Col., N. Y.
Willis, Mary A.............	....	Apr. 8, '86	Eclectic Med. Col., N. Y.
Yelvington, Charles H...	....	Mar. 6, '86	Eclectic Med. Col., N. Y.
Hayunga, George A.......	....	Mar. 3, '86	University City of N. Y.
Kelley, Bride Gertrude...	....	Mar. —, '84	New York Col. of Medicine.
Bunn, Lucilla L....... ...	....	Mar. —, '85	Electropathic Inst., Phila.
Luce, Edward P............	....	—— —, '62	Ohio College of Medicine.
Zettell, Charles Alfred....	....	Apr. 25, '81	Univ. Ludovico, Max'n, Bav.
Villavelt, Charles J........	....	June 25, '69	Eclectic Med. Col., Penna.
Kunze, Richard E.........	....	Mar. 11, '68	Eclectic Med. Col., N. Y.
Cudlipp, Edward Arthur	....	Mar. —, '86	University City of N. Y.
Mellen, Sam. Fairbanks..	....	Mar. 5, '84	University City of N. Y.
Putnam, Charles E.........	....	Apr. 15, '86	Hom. Med. Col., N. Y. City.
Wilson, W. Stockton......	....	Mar. 1, '61	Jefferson Med. Col., Phila.
Halves, Frederick..........	....	Mar. —, '70	Bellevue Hosp. Med. Col.
Warwick, Hill Sloane.....	....	Oct. —, '86	Col. Phys. and Surg., N. Y.
Goode, Lemuel George....	....	July 15, '86	University City of N. Y.
Heele, George Edwin......	....	Mar. —, '86	Col. Phys. and Surg., N. Y.
Dwyer, Timothy...........	....	....	Acad. Julio, Maximill'n, Bav.

HUNTERDON COUNTY.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCALITY.
Davis, David..........	Whitehouse.........	Mar. 15, '86	Col. of Phys. and Surg., Md.
Farrow, Edwin F.........	Pottersville.........	May —, '86	Col. of Phys. and Surg., N.Y.
McGill, Peter...............	Lambertville	Mar. 14, '79	University of Penn., Phila.
Oley, S. Willard............	Lambertville	Apr. 15, '86	Hom. Med. Col. of N. Y.
Silvara, Joseph W.........	Ringoes	Mar. —, '74	Jefferson College, Phila., Pa.

MERCER COUNTY.

Burroughs, Charles R.....	....	June 3, '85	Long Island Med. Col., N.Y.
Severns, Albert W.........	....	Apr. 20, '70	Col. of Phys. and Surg., Ont.
Witte, Eugene B...........	Chambersburg......	Apr. 15, '85	Hom. Med. Col., N. E.
Greene, J. Alonzo..........	....	May 27, '67	Eclectic Med. Inst. of Cin., O.
Romain, Lyon.........	....	Apr. 25, '69	Paris Med. and Surg. Faculty
Bailey, Alfred Wm..	....	Mar. 31, '86	Hahneman Col., Phila.
Costill, Henry B...........	Chambersburg.....	Mar. 15, '82	University of Penn., Phila.
Beatty, Henry M.	Trenton..............	Apr. 2, '85	University of Penn., Phila.
Cooper, James R...........	Trenton..	Mar. 31, '86 Apr. 2, '85	Hahneman, Philadelphia. Jefferson College, Phila.
Macdonald, Walter G. S..	Millham	May 10, '82	Univ. Col. of Victoria, Can.
Johnston, Frank...........	....	Mar. 1, '83	Col of Phys. and Surg., Md.
Rogers, William T........	....	Apr. 3, '85	Hahneman Med. Col., Phila.
Johnson, Edward W......	Chambersburg.	May 1, '86	University of Pennsylvania.
Preston, Margaret H......	Trenton..............	Mar. 13, '84	Penn. Med. Col. for Females.

MIDDLESEX COUNTY.

Davis, David................	Milltown......	Mar. 15, '86	Col. of Phys and Surg., N.Y.
Greene, J. Alonzo.........	....	May 27, '67	Eclectic Med. Inst. of Cin., O.
Hanson, Frederick A. T..	....	June 5, '31	Copenhagen Royal Univ.
Hults, E. Arthur...........	....	Mar. 31, '86	Hahneman Med. Col., Phila.
Prentis, Robert.......	....	Mar. 2, '70	Col. Phys. and Surg., N. Y.
Rome, R. B..................	....	Mar. 1, '85	University of Pennsylvania.
Riva, Ferdinand E..	New Brunswick...	Mar. 1, '86	University of Pennsylvania.
Siggins, John J.	....	Mar. 2, '85	Michigan Medical College.
William, Samuel S..	Bound Brook......	May 29, '83	Univ. of the City of N. Y.
Yound, Edwin B...........	New Brunswick...	....	Affidavit filed in pursuance of statute.

MONMOUTH COUNTY.

Appleman, Parmenas.....	....	Mar. 14, '82	Col. Med. and Surg., Phila.
Allan, Arthur G...........	....	Mar. 15, '78	University of Pennsylvania.
Arnold, Glover Crane.....	....	Mar. 1, '73	Bellevue Hosp. Med. Col.
Burton, Irwin G...........	....	Feb. 26, '86	Col of Dentistry, Phila., Pa.
Bailey, Alfred Wm........	....	Mar. 31, '86	Hahneman Col., Phila., Pa.
Bradner, W. K.............	....	Oct. 1, '75	Bellevue College, N. Y.
Curtis, Thomas A..........	....	May 13, '86	Columbia College.
Fuller, F. C..................	....	Mar. —, '82	Columbia College.
Glaser, Joseph...	....	Feb. 29, '64	University of Jazcellonica
Hunt, Ida B........	....	Apr. 1, '80	Female Med. Academy, N.Y.
Henry, Frederick P.......	....	Feb 26, '68	Columbia College, N. Y.
Kynett, Harry Havelock	....	May 1, '86	University of Pennsylvania.

MONMOUTH COUNTY—Continued.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCALITY.
Kennedy, Wm. C.		Mar. 4, '80	Missouri Medical College.
Lewis, Louis		July 31, '62	Royal Col. Surg., England.
Lloyd, Samuel		Sept. 28, '85	Col. Phys. and Surg., N. Y.
Lloyd, Edward Morris		Apr. 2, '86	Jefferson College, Phila.
Mortimer, Fairfield			Eclectic College, N. Y.
Reed, E. B		Mar. 9, '84	Jefferson College, Phila.
Teschner, Jacob		Nov. 9, '80	Col. Med. and Surg., N. Y.
Tantum, Percy L.		Apr. 2, '86	Jefferson College, Phila.

MORRIS COUNTY.

Brown, D. N.		Feb. 22, '81	Eclectic Med. Col., N. Y.
Frazer, Samuel H.		Mar. 7, '79	Eclectic Med. Col., N Y
Mabon, William		Aug. 1, '81	Bellevue Hosp. Col., N. Y.

OCEAN COUNTY.

Cate, H. J. M.	Lakewood	June 13, '49	Vermont Medical College.
Bruyere, John	New Egypt	Mar. 28, '84	Jefferson College, Phila.
Neilson, Thomas R.	Point Pleasant	Mar. 15, '80	University Pennsylvania.
Clayton, Joshua	Point Pleasant	Apr. 2, '86	Jefferson College, Phila.
La Forge, C.	Barnegat City	Mar. 26, '86	College of Medicine, Balt.
Williamson, M. S.	Beach Haven	Mar. 11, '72	Hammerson's C. of M., Phila.
Hall, A. Douglass	Bayhead	Mar. 10, '54	Jefferson College, Phila.
Brown, D. H.	Bayhead		Col. of Phys. and Surg., Col.

PASSAIC COUNTY.

Brockway, Millard F.	Paterson	Mar. 6, '81	Electic Med. Col., N. Y.
Craig, James T.	Paterson	Mar. 15, '86	Bellevue Hosp. Med. Col.
De Baun, Edwin	Passaic	Apr. 16, '85	New York Hom. Med. Col.
Doty, Edward W.	Paterson	June 2, '86	Long Island Hosp. Med. Col.
Greene, J. Alonzo	Paterson	May 27, '67	Eclectic Med. Inst., Cin., O.
Heckman, William	Paterson	June 17, '67	University of Groningen.
Moran, Peter F.	Paterson	Mar. 14, '83	Bellevue Hosp. Med. Col.
Meyers, George H.	Paterson	May 13, '86	Col. Phys. and Surg., N. Y.
McNair, David	Paterson	Mar. —, '54	N. Y. Med. Col.
Merrill, John R.	Paterson	May 13, '86	Col. Phys. and Surg., N. Y.
Siggins, John J.	Paterson	Mar. 6, '85	Michigan Med. Col.
Sovereen, Albert W.	Paterson	Apr. 20, '70	Col. Phys. and Surg., Ont.

SALEM COUNTY.

Daniels, L.	Lewistown, Me.	June 24, '86	
Fullmen, John		Feb. 8, '58	Eclectic Med. College, Pa
Harris, Francis B.	Canton	June 1, '86	Eclec. Med. Ins., Cincinnati.
James, William Henry	Pennsville	—— —, '85	University of Vermont.

SOMERSET COUNTY.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCATION.
Carman, J. H.	Plainfield	Mar. 1, '81	Col. of Phy. and Surg., Balt.
Van Doren, Richard S.	Liberty Corner		University of City of N. Y.
Conover, Ellsworth E.	Martinville		
Wright, Josephus E.	Somerville	Apr. 2, '84	Hahneman Med. Col., Phila.
Connolly, William H.	Somerville	Apr. 16, '85	
Hall, John V.	Somerville	Feb. 25, '75	Penna. Col. of Dental Surg.
McWilliam, J. F.	Somerville	Mar. 29, '84	Jefferson Med. College, Phila.
Sovereen, A. W.	Plainfield	Apr. 20, '70	Col. of Phy. and Surg., Ont.
Davis, Edwin F.	Bound Brook		Hahneman Med. Col., Phila.

SUSSEX COUNTY.

Miller, Jacob W.	Layton		Columbia College, N. Y.
Dalrymple, Edward S.	Branchville		University of New York.

UNION COUNTY.

Burdge, Paul W.	Rahway	Mar. 26, '78	University of Pennsylvania.
Burseau, Josephine Ida.	Elizabeth	Apr. 1, '85	N. Y. Med. Acad. for Women.
Greene, J. A.	New York City	May 27, '67	Eclec. Med. Ins., Cincinnati.
Kuhry, Celia S.	Plainfield	June 30, '85	Ann Arbor Univ. of Mich.
Murray, William H.	Plainfield	May —, '81	Col. of Phy. and Surg., N. Y.
Penfield, Charles H.	Plainfield	Mar. 2, '81	State University of Iowa.
Pierce, Frank B.	Elizabeth	Mar. 2, '85	University of New York.
Pendleton, E.	Brooklyn, N. Y.	Mar. 6, '69	University of City of N. Y.
Sovereen, A. W.	Plainfield	Apr. 20, '70	Col. of Phy. and Surg., Ont.
Wethli, Sophie.	Elizabeth	Nov. 24, '85	Columbia Col. of Midwifery.

WARREN COUNTY.

Carhart, Henry Osborn.	Phillipsburg	———, '86	Jefferson Med. Col., Phila.
Hoagland, Bonn W.	Oxford Furnace	———, '86	University of Pennsylvania.
Paul, Comegys.	Belvidere	———, '69	University of Pennsylvania.
Cook, Richard L.		———, '86	Col. of Phy. and Surg., Md.

REPORT

OF THE

BUREAU OF VITAL STATISTICS

OF THE

STATE OF NEW JERSEY

FOR THE

Statistical Year from July 1st, 1885, to July 1st, 1886,

WITH CLIMATOLOGY, ETC.

DEPARTMENT OF STATE.

TO HON. HENRY C. KELSEY, SECRETARY OF STATE.

By EZRA M. HUNT, M.D., Sc.D.

Secretary and Medical Superintendent of Vital Statistics.

REPORT OF VITAL STATISTICS.

INTRODUCTION.

The wealth and welfare of a State reside in its population more than in any other of its resources. Indeed, its numbers and condition are the only definition and test of its prosperity. It is in vain that we point to all its other possessions, if we are not able to secure for it inhabitants, and such inhabitants as have at least an average length of life and a good degree of health. That nation makes a great achievement which is increasing in a population that shows more than an average length of life and more than an average of effective working life. Over-production is more likely to occur in some other directions than in that which secures a healthy native population, with vigor for all industrial occupations, and with that prosperity and happiness which such health and such life are likely to secure.

Nordhoff has well said, "There is no surplus population in the world. When there appears to be it is only that some one is in the wrong place. Enable any such one to go elsewhere, and teach him that he shall, if need be, *do something* else, and he is no longer surplus, but highly necessary to civilization. More than one-half of our planet still lies waste and useless, and suffers for lack of strong arms and stout hearts to redeem it. Long ago the words of Solomon were on record: 'In the multitude of the people is the king's honor, but in the want of people is the destruction of the prince.'" Even this can be said of such a State as this. It is because, in the interests of political economy not less than in those of comfort and contentment, we need to keep account with the population, that vital statistics have a defence even beyond all other statistics. They form, in many respects, the basis on which all other statistics rest. Since it has been proven that so many diseases are avoidable or can be avoided, it becomes essential to trace human life in its vital relationships, in order

that we may know how to prolong it and how to protect it from evils incident to life and labor, but which admit of modification and control.

Dr. Owen had said what Spencer has repeated, that "the average duration of human life is the most definite measure we can apply to the advance of civilization, which also means national prosperity." Many of the European countries have so long and so thoroughly tested the advisability and success of such records that newer countries can follow out the system with the greatest confidence in the good results. For instance, there has been in the last ten years a marked and progressive reduction in the English death-rate, which comparisons of localities show to have to a good degree resulted from a study of the sickness and mortality and of the sanitary improvements resulting therefrom. When for ten years England and Wales can show a death-rate of less than 20 per thousand, and the largest cities of England taken together a rate of 20.9 per thousand and a progressive reduction, we have a model up to which we have great reason to attempt to work. "It cannot," says one, "in the interests of further health progress, be too constantly borne in mind that the commencement of this period of reduced death-rate was coincident with the coming into full operation of the Public Health Acts of 1872 and 1875. The effect of this reduced death-rate upon the numbers and longevity of the English people is phenomenal. The Registrar-General points out that the reduction in the death-rate in the last five years implies that 'more than 281,000 persons in England and Wales survived that period, whose deaths would have been recorded had the mean rate of mortality been equal to that prevailing in the ten years of 1871–80,' in the latter half of which period the improvement in the public health had already set in. With regard to the increased longevity of the population, Mr. Noel Humphreys, in a paper read before the Statistical Society in 1883, showed that the effect of a reduction in the mean death-rate from 22.5 in 1838–54 to 20.8 in 1876–80 would be to add two years to the mean duration of life of every male, and three years and a half to that of every female born. The further reduction of the death-rate in the last five years to 19.3 implies a still greater additional lengthening of the mean duration of life in England."

Liverpool was once noted for its excessive mortality. It entered upon a system of exact record of vital facts as to its population and

of systematic care of the city, for its sanitary improvement. We insert the following comment of the London *Lancet* on the results:

"In the annual report of 1886 on the city of Liverpool we have some interesting information bearing on the gradual improvements which are there being effected in securing an improvement of the public health. We have recently adverted to some of these in connection with the report of the city engineer on the sewers; and it is not less important to note the steps that are being taken to get rid of the bad house-property, which has for so long a time been one of the greatest evils which the corporation have had to contend with. The 'insanitary property' purchased in 1885 included 411 houses, and during the same period 631 houses were demolished. This may be taken as a type of the work which is steadily in progress; and Dr. Stopford Taylor points to the results of these and other labors by showing that whereas the average death-rate for the city was in ten years 1841–50 as high as 36 per 1,000, it has almost uniformly diminished during each subsequent period until it now stands at 23.7 per 1,000. He then goes on to point out that the application of the sanitary sciences to the improvement of public health is necessarily a work of an aggressive character, and hence, though its development is certain, yet the securing of its full advantages is a slow process. The aggressive action is also fully justified by the results obtained. Thus if during 1885 the same death-rate had prevailed as was in existence during the decennium 1851–60, the lives of no less than 3,917 persons who were living at the end of last year would have been sacrificed. And, assuming that there are ten cases of sickness for each death, there was a saving of 39,170 cases of disease, with all the attendant cost of nursing, medical attendance, &c. And not only so, but every life has its value so far as the State is concerned. Taking a series of observations on the wages of the agricultural laborer, and making the necessary deductions for the mean value of his subsistence during the various periods of his life, the mean net value of life in that class at all ages and in both sexes is not less than £110 per individual; whereas amongst the population of all grades the value would amount to a net profit of £159 per head. Now, applying this estimate, which is that determined by the late Dr. Farr, to the 3,917 persons whose lives were saved in Liverpool in 1885, there is a monetary saving of £622,803. And when to this is added the saving in the cost of sickness, funerals, loss of work, and increased pauperism, Dr. Stopford Taylor has the right to assume that there is enough to encourage the labors of the department over which he presides, and to inspire them with a hope of obtaining still greater benefits in the future."

Another significant illustration is as follows:

"*The Influence of Sanitary Works at Merthyr-Tydfil.*—Mr. Dyke, the well-known health officer to the town of Merthyr-Tydfil (population, 101,441), has now completed a series of twenty annual reports, and in so doing he makes a summary showing the proportion of deaths per 10,000 persons living during a series of groups of years. The first period is that from 1845 to 1855, before any sanitary works were commenced; the second includes the six years 1856–61, during which paving works and removal of nuisances were attended to; the third relates to the four years 1862–65, whilst the works specified were still being carried out, and whilst water was also being laid on to the houses; the fourth includes the ten years 1866–75, when the water-supply was perfected, whilst the sewers and drains were being laid and whilst the sewage disposal was being completed; and a fifth deals with the ten years 1876–85, when the whole of these completed works were in operation. The table shows a gradual and continuous reduction of the death-rate from all causes from an average of 332 per 10,000 in 1845–55, to one of 231 in 1876–85, the proportionate mortality of infants under one year of age being reduced from 80 to 45 per 10,000. The rates from the contagious fevers—measles, scarlet fever and whooping-cough—do not seem to have been in any way affected by sanitary improvement. This we were prepared for; but it is curious that the same applies to diphtheria. Probably this is due, not so much to the fact that this latter disease is independent of sanitary conditions, as to the circumstance that diphtheria has of recent years been much more widely diffused in this country than it was during the earlier periods referred to in the table. On the other hand, there has been a marked diminution in the other forms of "fever." "Continued fever" has practically ceased to exist as a separate disease—a circumstance doubtless due to improved nomenclature; and the mortality from typhoid or enteric fever has fallen from 21 to 3 per 10,000. The death-rate from infantile diarrhœa has also fallen from 11¼ to 4 per 10,000; and the average age at death has increased from seventeen years and a half to twenty-seven years and a half, a clear gain of ten years of life. It will be observed that in making these comparisons Mr. Dyke is following out the plan adopted by Dr. Buchanan in 1866, when he reported on the results of the adoption of sanitary works in many of our large towns, including Merthyr-Tydfil, and hence it is appropriate that the information as to the results of the drying of the subsoil by the construction of sewers should be specially dealt with and brought up to current date. The influence of such drying has brought about a reduction in the phthisis death-rate from 38 to 22 per 10,000; but acute and chronic bronchitis and pneumonia have, during the same period, become more fatal, the corresponding rate for this group of affections having risen from 33 to 45—a result due, in the opinion of Mr. Dyke, to the con-

tinued occupancy of damp and unventilated dwellings. On the whole, this summary affords the most convincing proof that properly-planned and well-executed sanitary works result in a vast decrease in sickness and death, and by producing healthiness and increased duration of life, they become a source of profitable income to the communities affected by them."

Results similar to these are found in States like Massachusetts and in cities in which sanitary measures have been most vigorously carried out. We cannot record accurate results only because of shorter periods of observation and of the evils arising from the rapid and too often insanitary growth of cities.

MORTALITY AS A TEST OF HEALTHFULNESS.

The question is occasionally raised how far the number of deaths is a test of the healthfulness of a locality. It is recognized by all vital statisticians that the simple proportion of the annual deaths to the population is not alone an accurate measure of the general health. But it is equally recognized that its accurate estimation is an approximation to correctness in the hands of competent persons. It must be ascertained as one of the first data for comparisons. It has been conclusively proven that the laws of disturbance do not destroy the value of death-rates as a general and approximate test of health conditions. There must, however, be a careful attention to the inter-relations of birth-rates and death-rates; to the proportionate ages at death, and to the causes of the mortality. We must know the material, as subjected to disease, its age, its surroundings and its proportion to the less-susceptible portion of the population. When alongside of the mean duration of life we place the respective ages of the population a classification of the diseases of which they have died, comparisons of deaths, and of numbers, ages and causes of death in different parts of counties or districts, we have materials for safe conclusions, if only the numbers dealt with and the space of time are enough to eliminate such sources of error as arise in dealing with approximate figures in narrow limits. The laws of population, and the variations induced by artificial circumstances are so uniform as to admit of scientific determination. We may equate or get rid of a periodical or prevalent cause of fluctuation and present a result as it would have been, had the cause of fluctuation had no existence. For sanitary purposes we need most of

all to know (*a*) the proportion of deaths to population; (*b*) the number of deaths referable to the principal communicable diseases, and (*c*) the infant mortality measured by the proportion of deaths of children under one year of age to births; (*d*) as also, the number of deaths at classified ages. Guided by such testimony local authorities have over and over again proceeded to investigate the relations of the deaths to the kinds of sickness, and then of both to existing insanitary conditions. Improvements made on such a basis have produced such a decrease of death-rate as over and over again to have given such life results as those already quoted. The tables of each year in all of their divisions should be compared with those of previous years as, also, with changes in local conditions, which may have been operative. It is pleasant to know that in some of our larger cities, the health officers are not only profiting from present indications, but are compiling and comparing results on the records of several years, and different wards or localities.

MARRIAGE, AND LAWS AS TO IT.

The relation of marriage has to do with the fundamental interests of society. Whatever theories may have been advaneed heretofore, or whatever customs may have been in vogue in different countries, the constitutional governments of modern civilization take it for granted that the family is the basis of the State. It recognizes no other unit of population. It concerns itself with the act and conditions of marriage, not merely because of certain legal necessities growing out of it as a compact and contract, but because its conditions concern national existence and national permanency. A nation consisting of unmarried men and unmarried women is inconceivable. Marriage is a part of the organic law of nations; a necessity for perpetuity. The fact that the law recognizes it as a civil relation does not in the least remove it from its close moral and social status. Although a contract, it is not dealt with as an ordinary contract. Although regulated wholly by statutory provision, yet the statutes respect ecclesiastical views as to many of the relationships beyond those of blood kinship, and still recognize the priest or minister as the chief officer to declare any such union consummated. It speaks of solemnizing marriage, of joining persons in the holy bonds of matrimony, and throughout the statutes applies such language to the act as performed by various officers. The law holds itself in close relation to

all that concerns it, and claims the right to place upon it, and the modes and places of its performance, such restrictions as it believes the welfare of the State to demand. It therefore must give expression to this care in such ways as seem to conduce to this end, although some of them may seem arbitrary to those who have not fully studied the reasons.

Thus, it arbitrarily defines the age at which a person becomes marriageable without the consent of parents or guardians, and makes the ages different for the different parties to the contract. It prohibits a widower from marrying the wife of his deceased grandson or the mother of his deceased wife, as definitely as if they were of the closest blood relation.

In most countries it has not been considered obtrusive to demand that either the church or the State has due notice of the contemplated union on the ground that its interests were essentially involved in the act. In Roman law, the most complete marriage (*confurreatio*) required the presence of two witnesses. The Germans early insisted upon previous notice. How particular the German government is at present, as to the conditions of and protection in marriage where there has been residence outside of the country, is illustrated in the following proclamation, recently made in a New Jersey paper as to a person who had gone from this State to Germany, for the purpose of marriage:

"PROCLAMATION.

"Adreas, Christian August W., farmer, residing in M., son of Johann Ernst W., farmer, and his wife Martha Elizabeth, whose maiden name was Temme, both deceased, and at the time of their death residing in M., in North America, intends to marry Anna Francisca Dorothea Margaretha R., living at Erfurt, daughter of Wilhelm R., tradesman, and his wife Charlotte Friederike, whose maiden name was S., both living at A. His intention is hereby made public, with the request that any objections to his marriage must be handed in writing to the undersigned magistrate within fourteen days from the day on which this proclamation appeared in the M. *Inquirer*.

"ERFURT (Germany), January 13th, 1885.

"Der STANDESBEAMTE,

"TEGETMEYER."

Until quite recently, in England, marriage was an ecclesiastical ordinance. In the Catholic Church it is a sacrament. Now, in

England, the celebration of marriages is regulated wholly by statutory legislation. It regulates marriages within the Church of England, but was intended to be of universal application, Jews and Quakers only being excepted. These were well known to be very strict as to conditions. The law requires either the publication of banns or a license from the proper ecclesiastical authority. As to banns, they must be published on three successive Sundays in the church of the parish in which the parties dwell. The bishop, however, may authorize the publishing of the banns in a public chapel. Seven days' notice must be given to the clergyman of the names of the parties, their place of abode and the time during which they have lived there.

France requires banns to be published, and eleven days must elapse, including two Sundays. The Roman Catholic Church is everywhere particular as to a knowledge of the parties. For instance, a priest does not perform the ceremony outside of his parish, and a marriage, in order to be recognized by the Church, must be solemnized by its clergy. The ceremony always occurs in the daytime. The restraints on hasty or improper marriages and upon divorce seem very effective.

It is to the great credit of this State that its laws as to divorce are much better guarded than in most of the States. The grounds on which divorce is granted are more restricted, and the relations of the Court of Chancery are such to the securing of testimony and to the final decision as to restrain a tendency too manifest in many countries. Up to 1795, the State law as to marriage was the same as that passed in 1709 under the Crown (George I.) So far as license is concerned, it only required license when either party was under the age of twenty-one, and then required not only license and such notice as would give full time for parents or guardians to prevent the marriage, but also a bond of indemnity, as follows:

"Know all Men by these presents, that (We, David Allen and John Hyer, both of the County of Monmouth, are) holden and do stand justly indebted unto (his Excellency Jonathan Belcher, Esq., Captain-General, Governor-in-Chief of New Jersey,) in the sum of (five hundred pounds) of Lawful Money of New Jersey, to be paid to his said (Excellency), his Successors or Assigns, For the which Payment, well and truly to be made and done, (We) do bind (Our)sel(ves), Our) Heirs, Executors and Administrators, and every of them (Jointly & Severally) firmly by these presents. Sealed with (Our) Seal(s). Dated this (Nineteenth) Day of (July), Anno Domini One Thousand Seven Hundred and Forty (Eight.)

"The Condition of this Obligation is such, That whereas the above-bounden (David Allen) hath obtained License of Marriage for (himself) of the one Party and for (Sarah Van Dike, of the same County,) Spinster, of the other Party: Now, if it shall not hereafter appear that they, the said (David Allen and Sarah Van Dike,) have any Lawful Let or Impediment of Precontract, Affinity or Consanguinity, to hinder their being joined in the Holy Band of Matrimony, and afterward their living together as Man and Wife, then this Obligation to be void, or else to stand and remain in full force and Virtue.

"Sealed and Delivered in the presence of David Allen.

"JOHN SMYTH. JOHANNES HYER."

From 1736 to 1792, I think, this law lasted. In 1795 the law was so altered that the woman desiring marriage could be married after the age of eighteen without consent, but if either the man was less than twenty-one years of age or the woman less than eighteen, certificate of consent must be produced and sworn to as correct by a witness accompanying the parties.

It is implied that if the parties claimed to be of age, and the person asked to perform the ceremony had any doubt, he might cause the parties to take oath or affirm their age. Such, at least, has been the precautionary custom with many of those officiating for young and unknown couples.

We are aware that there is a sentiment on the part of many that there are not enough restrictions against hasty or ill-advised marriages, and that there is need of some legislation to secure more deliberation or greater restraint. In Pennsylvania this has taken the form of an enactment requiring the obtaining of a license. This very feebly accomplishes the object aimed at, if the experience of other States has been similar to this. Since the law went into effect, the number of marriages in the city of Camden alone has increased over 2,000 a year. In the past year, between 2,500 and 3,000 Pennsylvania couples have been wedded in the State of New Jersey. It has so far become a Camden and clerical industry that at least one party has had a map constructed and placarded to show to anxious couples crossing the Camden ferry the way to the marriage bazaar. A bill for a similar law was before the New Jersey Legislature at its last session, but failed to become a law. It does not seem to us that any such State law will accomplish the object sought. So far from this, it not only does not restrain, but seems to prompt to marriages away from the home district and to lead to many confusions likely to arise whenever

rights of property or other questions as to these scattered marriages may come before the courts.

The marriage returns of persons non-resident in our State during the year ending June 30th, 1886, in the four counties bordering on Pennsylvania, were as follows:

Camden city	2,157
Hunterdon county	34
Mercer county and cities	71
Warren county and Phillipsburg	265
	2,527

There are many scattered additions in other cities and counties.

We are aware that some of the ministers of various denominations are thinking that there is need of some legislation. Some of them believe that a method of notice in all cases is in the interests of society and good morals, and advocate it on these grounds. The desire of the most, however, arises from that portion of the law which holds them responsible for the marriage of minors. Some supplements and amendments, and perhaps some imperfect statement in the laws themselves, may lead the non-legal reader not fully to understand the law. Not a single section of the foundation law of 1874 stands as then enacted, except the first section, defining the persons who are not intermarriageable. Of Section 2, all remains except that the law (Chap. 143, 1882,) adds the judge of any court of common pleas, recorder and police justice and mayor of any city in this State as among those who may solemnize marriages. Sections 3, 4 and 5 remain, except so much as requires the person solemnizing the marriage to record or register a certificate in the county clerk's office. The only certificate now registered is that of marriage, as provided for in the law of 1879. This is now sent to the assessor or city clerk for transmission to the Bureau of Vital Statistics, at Trenton. But the person solemnizing marriage of a minor is still under the obligation of requiring a certificate of age in case of a minor, as provided in the law of 1874, and of taking the oath of any person who claims not to be a minor but is suspected of being such by the party asked to perform the ceremony.

The form of marriage return of this State has on its back a form, in which all persons can be asked to assert the facts contained in the certificate of return, as an additional protection. It is impossible for any one solemnizing a marriage of a minor to run any risk of suit if he will follow so much of the law as says that a minor shall have the

certificate of the parent or guardian and be accompanied by a person who makes oath that he was present at the signing. In case a person appears whose statement as to his or her age is doubted, an oath can be required as to the correctness of the statement. It would be well if the law of 1879 required this to be transmitted with the return of marriage.

The only real risk arises to the parents or guardian that the child or ward will be married without consent. If there is need of greater guard as to this, how can it be secured? We have already expressed the doubt whether it can be done by the public notice of banns or a previous public license. The evil results mostly from causes that must be dealt with in families and has no remedy in legislation.

Legislation is not so much a remedy for all the infelicities of social life as some imagine. Yet, as it may to some degree restrain the results of social defects, and conservative legislation may be thought of, some of the suggestions made to us are as follows:

(*a*) Marriages should not be performed in the State by persons residing out of the State. (*b*) One of the parties should reside in the county or city in which the ceremony is performed. (*c*) The right to join persons in wedlock should not belong to so many persons or classes of officers. (*d*) No person should be allowed to perform the ceremony unless knowing one of the parties. (*e*) If license is required at all, it should only be of men under twenty-one and women under eighteen years of age, and only for about five days before marriage.

The chief embarrassment seems to arise from the fact that so many couple are led to secure marriage without consent of parents or guardians, by concealing their ages, and from the fact that the laws of the various States are so little in harmony.

It would be possible greatly to remedy this evil if the law required that all persons before proceeding to be married should make oath that each of them is beyond the age of eighteen and twenty-one, respectively, or, if not, should make oath in the presence of parent or guardian or of a witness to their signature that consent has been thus certified.

If any such law were enacted it need not require public notice. In such case those authorized to perform the ceremony should not have power to grant the license. The best persons to give the license would be the assessor of the township and the city clerks of the respective cities in which the party resides, as marriage certificates are

returnable to the State through these officers, and as convenience is thus consulted. It should then be the duty of all those performing the marriage ceremony to return such license with the certificate of marriage to the assessor or city clerk. All assessors and city clerks should be furnished the forms of license from the Bureau of Vital Statistics, as they are now furnished with blanks for other returns.

These suggestions are made not as recommendations, but because the last year large and influential church organizations and judicious citizens have given utterance to the view that somehow there should be greater guard put upon hasty or illegal marriages; greater protection for those authorized to solemnize marriage, and fewer marriages of unknown parties.

A review of the various laws and a knowledge of some of the evils arising from attempted restrictions lead us to believe that our laws as to marriage need no radical change, although some restatement may be desirable. If every one who has the right to perform this ceremony would be careful to marry no minor without an oath or affirmation that he or she is of full age, there would be fewer hasty marriages.

The returns are well made in this State. The originals and the index are made accessible for all legal purposes, through letters or personal request, and for vital statistic purposes they afford valuable facts bearing on population, social conditions and the causes of disease and death.

RETURNS OF BIRTHS.

As we need to know the birth-rate in order to know of the increase of native-born population, as also to know the actual growth in this material resource, and as also we need to know the age of the persons with whom disease and death are dealing, the record of the births becomes a necessity in any study of vital conditions of the population. In all countries it is the most difficult return to secure accurately. While it is generally conceded that the great legal contract of marriage must have record, and that a human being should not be placed under the ground without some record of the time, place and cause of death, births are more apt to be looked upon as family incidents of less import. But as no general statistician has ever ventured to suggest that such record should be omitted, and as each government reserves to itself the right of prescribing how and by whom such information shall be secured, we only need to adopt such methods

and such securement as will be nearest to completeness. The plan in this State is as effective as in the other States, and in advance of most of them.

Estimates of correction, for comparison with marriage and death returns, are made in several ways.

A sample is as follows: Add together the total births of the five previous years and deduct from the sum the number of deaths under one year of age in the first of these years, under two in the second, and so on. The remainders will be the number now living under five. The average of birth-rate is, in England, about 35 per 1,000. In Glasgow, the average for the last five years was 38.4 per 1,000.

In this State the number of children living under five years, as shown by the census of 1885, was 77,819. If we add to this all deaths of children under five years of age for the year ending June 30th, 1886, all under four for the year next previous, all under three for the year before that, and so on for four years, then all those dying in the first of the five statistical years at such ages as show them to have been born in that year, we get a result so approximate as to be applicable in determining the real amount of age-material that has been exposed.

In this State the number of families as shown by the same census was 267,394. It is impracticable to attempt to make general conclusions from the birth-returns each year, but in the usual quinquennial and decennial revisions they become more available.

The returns of births for the past year, as made to this office, exceed those of any previous year.

THE RELATION OF THE PHYSICIAN AND THE SANITARIAN TO HEREDITY, WITH STATISTICS AS TO IT.

BY LABAN DENNIS, M.D., NEWARK, N. J.

In the following article no claim is made to original discovery of the truths presented. Many of them have long been the common possession of the medical profession. The interested perusal of some of the writings of Francis Galton, F.R.S., followed by Ribot, Greg, Elam, Brooks and others, suggested the thought that if the facts which they present could be laid before physicians and sanitarians, even though imperfectly, they would, perhaps, be aroused to study the subject more thoroughly, to read its accumulating literature, and thus to make practical application of these truths for the benefit of mankind.

While it has been in preparation, an article on "Heredity" by Dr. Maudsley has appeared in the *Fortnightly Review;* an address on the "Relation of Heredity to Health and Longevity" was delivered in June last by Dr. Carpenter, of Baltimore, before the Pennsylvania State Sanitary Association, and published in the *Annals of Hygiene;* Dr. Preston has published an article in the *Popular Science Monthly* for September, 1886, on "Hereditary Diseases and Race Culture;" at a recent meeting of the British Scientific Association, Sir George Campbell, President of the section of Anthropology, took for his theme "Man Culture" and considered its relations to heredity. A reply to this by Grant Allen has appeared in the *Fortnightly.* These facts suffice to show that the minds of scientists and physicians are being aroused to the importance of our subject.

Some one has said, "Give me the first five years of a child's life and I care not who has charge of him afterward." Solomon said several thousand years ago, "Train up a child in the way he should go and when he is old he will not depart from it." On the other hand, Carlyle

in *Sartor Resartus* says: "It is maintained by Helvetius and his set, that an infant of genius is quite the same as any other infant, only that certain surprisingly favorable influences accompany him through life, especially through childhood, and expand him, while others lie close folded and continue dunces. * * * 'With which opinion,' cries Teufelsdröckh, 'I should as soon agree as with this other, that an acorn might, by favorable or unfavorable influences of soil and climate, be nursed into a cabbage or the cabbage seed into an oak. Nevertheless,' continues he, 'I too acknowledge the all but omnipotence of early culture and nurture. Hereby we have either a doddered dwarf bush, or a high-towering, wide-shadowing tree; either a sick yellow cabbage or an edible, luxuriant green one. Of a truth, it is the duty of all men, especially of all philosophers, to note down with accuracy the characteristic circumstances of their education, what furthered, what hindered, what in any way modified it.'" * * * Thus are stated briefly the opposing views which have been held as to the two great factors in human development, nature and nurture.

By *nature* we mean the product of those influences which for ages in the past have modified the human race, controlling, directing, stimulating or repressing; and so, presenting us the man inheriting all the vices and virtues of his progenitors. In this view we may say with Emerson, "Every man is a bundle of his ancestors." By *nurture* we mean the sum total of the agencies which may be brought to bear upon individuals after birth, whether by himself or his fellow-beings, for the direction and development of this nature.

Let us consider for a few minutes the relative importance of these two, and the physician's duty with reference to them. Heretofore the medical profession have been working on the side of nurture almost exclusively. But have we not duties yet unrecognized and consequently undone in the direction of nature? M. de Candolle, of the French Academy of Sciences, in a recent work on the laws of heredity, after an analysis of the lives and characters of two hundred scientific men of the last two centuries, arrives at the following general conclusions as stated in *Science:*

1. Heredity is a general law which admits but few exceptions.

2. The interruption of heredity through one or more generations (atavism) is rare, perhaps five or ten times in a hundred.

3. The more remarkable a person is for good or ill, the more numerous and pronounced are his characteristics.

4. Women show fewer distinctive characteristics than men.

5. All groups of characteristics are more likely to be transmitted by fathers than by mothers.

6. It is difficult to determine whether characteristics which have been acquired by education and other external circumstances are transmitted by heredity.

7. The most marked characteristics in an individual are generally those received from both parents, especially those received both from parents and other progenitors.

Mr. Galton, after carefully studying the lives of 180 distinguished scientific men of England, sets forth certain facts in a prominent light, which, for the purpose of understanding more clearly some of the laws that seem to govern heredity, we will analyze briefly.

Taking into consideration the antecedents of 107 of these men, we find descended from the upper and middle classes 104, from the lower, three. Hence, he says, "It is by no means the case that those who have raised themselves by their abilities are found to be abler than their contemporaries who began their careers with advantages of fortune and social position. They are not more distinguished as original investigators, neither are they more discerning in those numerous questions, not strictly scientific, which happen to be brought before the councils of scientific societies. There can be no doubt but that the upper classes of a nation like our own, which are largely and continually recruited by selections from below, are by far the most productive of natural ability." Thus he indicates the hereditary value of education extending through several generations.

As to the value of primogeniture, in a total of ninety-nine recorded cases, sixty-one belonged to the elder half of the family.

He concludes, therefore, "that the elder sons have, on the whole, decided advantages of nurture over the younger."

Under the head of fertility he finds the families to which scientific men belonged usually large. Thus, in about one hundred cases, the total number of brothers and sisters of these men averages 6.30, while of those who attained thirty years of age the average is 4.80. Comparing with these figures the number of the children of the scientific men themselves, he finds the number of *their* living children (say of ages between five and thirty) to be 4.70. "This implies," he says, "a diminution of fertility as compared with that of their own parents, and confirms the common belief in the tendency to an extinction of

the families of men who work hard with the brain. "On the other hand, I shall show," he says, "that the health and energy of the scientific men are remarkably high; it therefore seems strange that there should be a falling off in their offspring." He finds the only characteristics common to those scientific men whose families were the smallest to have been that they possessed a relative deficiency of health and energy in respect to that of their own parents. "Their absolute health and energy may be high, far exceeding those of people generally, but I speak of a noticeable falling off from the yet more robust condition of the previous generation. It is this which appears to be dangerous to the continuance of the race."

Speaking of the qualities possessed by these men, he says, "It will be seen that the leading scientific men are generally endowed with great energy; many of the most successful among them have labored as earnest amateurs in extra professional hours, working far into the night." Of those who reported definitely as to the energy of their parents, by far the greater number derived this quality hereditarily from one or both.

As to their health, he says, "The excellence of the health of the men in my list is remarkable, considering that the majority are of middle and many of advanced ages. One-quarter of them state that they have excellent or very good health, a second quarter have good or fair, a third have good health since they attained manhood, and only one-quarter make complaints or reservations.

"It is positively startling to observe in these returns the strongly hereditary character of good and indifferent constitutions. * * * All statistical data concur in proving that healthy persons are far more likely than others to have healthy progeny; and this truth cannot be too often illustrated until it has taken such hold of the popular mind, that considerations of health and energy shall be of recognized importance in questions of marriage, as much so as the probabilities of rank and fortune."

Perseverance he finds to be a third quality upon which great stress is laid, and which is uniformly possessed by these men, and almost universally derived from their parents.

Practical business habits are generally prevalent, and fully one-half of those endowed with them in a decided degree accredit one or both of their parents with the same faculty.

Memory he finds an important ingredient in that aggregate of facul-

ties, which form general scientific abilities. That is shown by the fact that about one-quarter of the men on his list possessed it in a high degree; but it is not an essential one, because it is defective in about one case in fourteen. Its hereditary character is abundantly illustrated by the histories of his subjects.

Independence of character, as among the qualities of especial service to scientific men, he finds marked in excess in fifty of his correspondents. In only two was it below par. Its hereditary character is shown by the fact that the home atmosphere which these men breathed in their youth was generally saturated with it. In confirmation of this he refers to the strange variety of small and unfashionable religious sects to which they or their parents belonged. Thus some were Quakers, Faraday was a Samdemanian, others were Moravians, Bible Christians; and Unitarians were numerous.

As showing the influence of hereditary causes in the production of the taste for science, his correspondents' replies show a larger proportion due to innate taste than any other cause.

Mr. Galton declares, "When nature and nurture compete for supremacy on equal terms, in the sense to be explained, the former proves the stronger. It is needless to insist that neither is self-sufficient; the highest natural endowments may be starved by defective nurture, while no carefulness of nurture can overcome the evil tendencies of an intrinsically bad physique, weak brain or brutal disposition. Differences of nurture stamp unmistakable marks on the disposition of the soldier, clergyman or scholar, but are wholly insufficient to efface the deeper marks of individual character. In the competition between nature and nurture, when the differences in either case do not exceed those which distinguish individuals of the same race living in the same country under no very exceptional conditions, nature certainly proves the stronger of the two."

This opinion strikingly corresponds with that of the physiologist Burdach, who says, "Heritage has in reality more power over our constitution and character than all the influences from without, whether moral or physical."

In two previous works, most interesting and instructive, "The Origin and Development of Human Faculty," and "Hereditary Genius," Mr. Galton shows how markedly those intellectual and physical powers which give stamina and distinction to families run through generations. He points out how early marriages give rap-

idly-increasing advantages in point of numbers to those stocks indulging in them. "Hence if the races best fitted to occupy the land are encouraged to marry early, they will breed down the others in a very few generations."

This brief summary will suffice to indicate Mr. Galton's estimate of the value of heredity in producing men of distinguished abilities.

Dr. Elam, in "A Physician's Problems," arrives at the following general conclusions: "In procreation, as in creation, we everywhere trace the operation of two principles, similarity and diversity. In obedience to the law of similarity, 'like produces like,' equally in species and in families. In obedience to the law of diversity, children differ from their parents and from each other. In accordance also with this law, there is the power of returning to the specific type, whatever may have been the modifications produced accidentally, or by the influence of circumstances, upon the race; even as, according to Dr. Darwin, the different varieties of pigeon evince a tendency to return to 'the Blue Rock' type. The diversity is produced by the very potency of operation of the law of similarity, whereby temporary and accidental conditions are propagated. Every formation of body, internal or external, every deformity or deficiency, from disease or accident, every habit and every aptitude—all these things are liable to be, or may be, transmitted to the offspring. In the case of accidental defects and modifications of the specific type, the offspring usually do not inherit them but return to the normal type. Intellectual endowments and aptitudes are liable to transmission, and according to the mental cultivation or neglect of the parents will be, as a general rule, the capacity and facility of learning of the children. This will be more evident in proportion to the number of generations through which such cultivation or neglect has been practiced. All moral qualities are transmissible from parent to child, with this important addition, that in the case of vicious tendencies or habits, the simple practice of the parent becomes the passion, the mania, the all but irresistible impulse of the child. Even when the very identical vice is not inherited, a morbid organization is the result, which shows itself in some allied morbid tendency or some serious physical lesion. All chronic diseases appear to be transmissible, either in the original form or in a transformation of the morbid tendency. These inheritances, normal or abnormal, are not always immediate from the parent, or even in a direct line, but they miss one or more generations,

and sometimes have only appeared in collateral branches, as an uncle or grand-uncle. This may be due to the fact that some of the inherited qualities may lie dormant in one member of a family and be active in others. Of all morbid heritages, unsoundness of mind, in its numerous forms, seems to be the most certain and constant, and the results form a considerable proportion of our criminal population. But whilst by the law of similarity children become subject to the imperfections of their parents, by the law of diversity they are enabled to escape from them. These evils are not necessarily entailed, and a proper comprehension of the principles upon which these diversities depend enables us to take such measures as will facilitate this escape. The offspring of that large portion of our population given up to intemperance and other forms of vice, inherit from their parents strong impulses and feeble wills, so as to become more or less irresponsible, and bear a peculiar relation to the law, such as needs special investigation. Matrimonial alliances should be so regulated as to avoid the most glaring evils mentioned above."

In support of these propositions, he adduces numerous facts which we can but briefly hint at. Thus he shows that the direct transmission of the qualities of the parent to the child is exhibited in external resemblance, in similarity of internal organization, in habit and gesture, in temperament, in instinctive impulses and in moral and intellectual tendencies and aptitudes. Also accidental defects and diseases are occasionally transmitted; certain vicious habits in parents and violations of hygienic law give rise to transformations and degenerations of both physical and moral nature, which may be said to foredoom the offspring to an unfortunate and miserable existence.

Resemblances of person, feature, etc., are illustrated by the Jews, gypsies, the aquiline nose of the Bourbons, the thick lip of the reigning house of Austria, which is said to be due to the marriage of the Emperor Maximilian with Mary of Burgundy over 300 years ago. The gigantic figures of the men and women of Potsdam are said to be due to the guards of Frederick William of Prussia having been quartered upon the town for fifty years. Breeders of cattle can modify at will a race by lengthening or shortening the limbs, increasing or diminishing the fat or muscle, or placing them in particular localities, as illustrated by the race-horse and dray-horse. Modes of walking, talking, peculiar gestures, left-handedness, fecundity, susceptibility to the action of certain drugs, longevity, albinism and melanism, super-

fluity of parts, as six toes and fingers, peculiar tastes and dislikes for certain foods and drinks, are all transmissible. Education has power to modify the capacity of the offspring as shown by pointers and St. Bernard dogs. The same is true of men; for example, the children of savages are less amenable to instruction than those of civilized people. Mathematical and linguistic aptitudes run in families.

Elam says: "I cannot see any reason for acknowledging that bodily habits and faculties are hereditary, and denying it in regard to those of the mind." In this matter, he says, "there is not that kind and amount of regularity which bespeaks law."

Genius in its highest forms seems not to be transmitted; but, as Mr. Galton has shown, talent, ability and superior powers are.

Elam shows that the moral faculties are subject to the same law. Propensities and tendencies to virtue and vice are hereditary, *not the acts themselves.* Man's freedom is not obliterated, but he is destined to a life of more or less strife and temptation according as his inherited dispositions are active and vicious or the contrary. Lecky says: "There are men whose whole lives are spent in willing one thing and desiring the opposite."

All the passions appear to be distinctly hereditary, as anger, fear, envy, jealousy, libertinage, gluttony, drunkenness.

Of the latter, a writer in the *Psychological Journal* says: "The most startling problem connected with intemperance is, that not only does it affect the health, morals and intelligence of its votaries, but they also inherit the fatal tendencies, and feel a craving for the very beverages which have acted as poisons on their system from the commencement of their being."

M. Morel says: "I have never seen the patient cured of his propensity whose tendencies to drink were derived from the hereditary predisposition given to him by his parents."

Special forms of crime are also hereditary. Lucas believes that in the formation of the criminal classes, hereditary influence is more powerful than education or example, adding "that as the latter would fail to make a musician, orator or mathematician, in default of inherited capacity, so they would fail to make a thief."

Theft has been known to run through at least three generations; so beating of parents, suicide, cruelty, vindictiveness and insolence are hereditary.

Not only are the permanent and established characteristics of

parents transmitted to children, but often also temporary, transitory, accidental and morbid modifications of structure. Thus youth, maturity, age and precocity may be reproduced in the offspring with qualities belonging to each.

From fifty to eighty-four per cent. of the cases of insanity are estimated to be due to hereditary influences. Maudsley calls attention to the immense importance of hereditary taint as a cause of insanity, and says that two considerations are to be borne in mind, first, the taint is of varying intensity, and may be developed only under certain favorable conditions. Second, not only may insanity in the parents predispose to insanity in the children, but any nervous disease, epilepsy, hysteria or neuralgia, may do the same; so, conversely, insanity may predispose to other forms of nervous disease.

Thus, by combinations of nervous disorders and physical and moral sins in the parents, there are developed in the offspring morbid temperaments, special deformities and anomalies, intellectual and moral aberrations, impulsive natures, proneness to yield to certain temptations, imbecile judgments, enfeebled will and torpid conscience. In all such, moral liberty is weakened, and these are the parents of the "dangerous classes."

The evils attendant upon consanguineous marriages should likewise be considered in this connection. They have been pointed out very frequently to be idiocy, scrofula, deafness, blindness and insanity. Even the union of persons unrelated, but of temperaments nearly alike, is not unattended by corresponding dangers.

The most complete and exhaustive presentation of the facts of heredity accessible to English readers, that has fallen into our hands, is the very able work of Th. Ribot, on "Heredity," (Appleton & Co.,) translated from the French. This author has drawn largely from all the prominent writers on this and kindred topics, such as Lucas, Spencer, Darwin, Buckle, Burdach, Maudsley, and a host of others, so that his book is a miniature cyclopædia of most interesting and valuable facts to be carefully studied by everyone concerned for the well-being of the race.

In his introduction he calls attention to the facts of physiological heredity, showing how children resemble their parents in external structure, in general appearance, in the limbs, the trunk, the head, even in the nails and the hair, but especially in the countenance, expression or characteristic features. Strangely, too, children may

undergo such metamorphoses as shall cause one to resemble at one time the father and at another time the mother. Heredity may also be traced in the complexion of the skin, the shape and size of the body; thus, obesity has been known to make its appearance under all the disadvantages of hard labor and poverty. So, too, the transmission of peculiarities in the form, size and anomalies of the osseous system, as in the proportions of the cranium, thorax, pelvis, vertebral column, and even the smallest bones of the skeleton, are of daily observation. Even the heredity of excess or defect in the number of the vertebræ and the teeth has been seen. The circulatory, digestive and muscular systems obey the same laws which govern the transmission of the other internal systems of the organism. So, too, heredity regulates the proportions of the nervous system. This is evident in the general dimensions of the brain; it is often apparent in the size and even in the form of the cerebral convolutions. It also regulates the fluids as well as the solid parts; the blood is more abundant in some families than in others, and this superabundance may transmit a predisposition to apoplexy, hemorrhage and inflammation. The same may be said with regard to the bile and lymph. So, too, fecundity, length of life, and those purely personal characteristics called idiosyncrasies are hereditarily transmitted. In some families the hair turns grey in early youth, and the vigor of the physical and intellectual faculties fails prematurely. In some, immunity from contagious diseases is a well-established fact. Heredity may transmit muscular strength in the various forms of motor energy, as seen in the families of athletes, prize-fighters, wrestlers and oarsmen. Some are possessed of exquisite dexterity and grace of movement, as shown by the transmission of a talent for dancing. So, too, peculiarities of voice with its defects, as stammering, speaking through the nose and lisping, the possession of great powers of singing, and the absence of all ear for melody, are transmissible. Even extreme loquacity seems to run in families. Dr. Lucas mentions the case of a servant girl who, when dismissed for incessant talking, not only to others but to dumb beasts, to inanimate things, and even aloud to herself, said to her employer: "It is no fault of mine; it comes to me from my father; the same fault in him drove my mother distracted, and one of his brothers was like me." The transmission of anomalies of organization is a well-observed fact. Thus, horny excrescences of the skin running through five generations have been observed; so, too, albin-

ism, rickets, lameness, hare-lip and all deviations from the normal type are seen. It is a disputed question whether these variations remain fixed or return gradually to the normal type. In proof of the latter may be mentioned the case of the Colburn family, in which each member had six fingers and toes. The anomaly continued through four generations.

The ratio of normal to abnormal was, in the first generation, 1 to 35; second generation, 1 to 14; third generation, 1 to 3½; showing a return to the normal type taking place very rapidly.

On this same point Dr. Gull says: "The strength of modern therapeutics lies in the clearer perception than formerly of the great truth that diseases are but perverted life processes, and have for their natural history not only a beginning, but a period of culmination and decline. The effects of disease may be for a third or fourth generation, but the laws of health are for a thousand."

Ribot points out, too, that even peculiar habits and modes of physical exertion are transmissible.

The bulk of his work, however, is taken up with the consideration of the heredity of intellectual and moral qualities. Thus, in his first chapter, he points out how natural instincts in men and animals are transmitted. In the next, how sensorial qualities, those of touch, sight, hearing, smell and taste, whether defective or in excess, are handed down through generations. In another he considers the gifts of memory with all its peculiarities, and shows how it is heritable. In the next he takes up the work of the imagination, as in writers, poets, painters and musicians, citing numerous cases of its hereditary character. In the fifth he considers the powers of the intellect, as exhibited in men of science, philosophers, economists and men of letters. In the sixth he treats of the sentiments and their abnormal variations, the passions, showing the heredity of general sensibility, of antipathies, of the sexual appetite, of dipsomania, of moral tendencies and their opposites, gaming, avarice, theft and homicide. In the seventh he considers the heredity of the will, the two classes of the mind active and contemplative, the transmissibility of the active faculties in statesmen and soldiers. In the eighth he takes up the heredity of national characteristics, and in the ninth morbid psychological phenomena, such as insanity, hallucination, suicide, homicidal monomania, demoniacal possession, hypochondria, presentiments, mania, dementia and general paralysis. In part second he considers

the laws of heredity, in part third the causes, and in part fourth the consequences, thus giving a complete statement of the relations of heredity to individual and social life, such as must furnish food for thought to all intelligent men of whatever station in life.

This brief sketch of the views of scientists as to the hereditary relations of families may be appropriately supplemented by a statement of the conclusions at which medical men have arrived as to the transmission of diseases.

A rapid glance over the pages of Carpenter, Ziemssen, Reynolds and Pepper shows that heredity is accredited with more or less influence in the production and development of alcoholism, cerebral anæmia, angina pectoris, aneurism of the aorta, asthma, atrophy, progressive muscular; hyperæmia, brain; hemorrhage, brain; hypertrophy, brain; calculi, renal; chorea, chlorosis; cancer, intestines, kidney, liver, stomach, uterus; convulsions infantile; catarrh, stomach; dementia paralytica, diabetes, dyspepsia, epilepsy, gastritis, gall-stones, goitre, gout, heart, dilitation, fatty, rupture of; hæmophilia, hay fever, hepatic congestion, hypochondriasis, hysteria, insanity, leucocythæmia, splenic; lymphadenosis, meningitis, cerebral, tuberculous; migraine, neurosis, stomach; neuralgia, neuropathic predisposition; paralysis, progressive muscular atrophy, phthisis pul., pseudo-hypertrophy muscles; rheumatism, spasm of the glottis, somnambulism, tabes dorsalis, spinal irritation and syphilis, affecting mucous membranes, bones, joints, glandular structures and the nervous system.

Thus is presented an outline of the evils to be avoided in hereditary descent. We have said that physicians heretofore have been laboring on the side of nurture; they have taken the human being, as brought into the world, and have endeavored to correct the evils found, with but slight reference to the doctrine of prevention. Sanitary science at the present day is bringing into greater prominence preventive medicine, as contrasted with curative medicine. We may appropriately ask ourselves, therefore, in view of the importance of this subject, what the profession can do to ward off these evils, and to develop a stronger and nobler race upon the earth.

Says Mr. Galton: "Man finds himself somehow in existence, endowed with a little power and intelligence; he ought, therefore, to awake to a fuller knowledge of his relatively great position, and begin to assume a deliberate part in furthering the great work of evolution. He may infer the course he is bound to pursue, from his observation

of that which it has already followed, and he might devote his modicum of power, intelligence and kindly feeling to render its future progress less slow and painful. Man has already furthered evolution very considerably, half unconsciously, and for his own personal advantages, but he has not yet risen to the conviction that it is his religious duty to do so deliberately and systematically."

We are met here, however, by another difficulty. Evolution among *races* has been governed by the principles of the "survival of the fittest."

Says Mr. Greg: "The abler, the stronger, the more advanced, the finer, in short, are still the favored ones; succeed in the competition, exterminate, govern, supersede, fight, eat, or work the inferior tribes out of existence." As instances we may mention the Indians of the Antilles, the red man of North America, the South Sea Islander, the Australian and even the New Zealander.

This principle of natural selection holds good also in the case of *nations*, examples of which are the Greeks overpowered by the Romans, and they in turn by the rude Northern warriors.

But when we come to the case of individuals in a people, or classes in a community, the principle would appear to fail, and the law is no longer supreme. Civilization with its social, moral and material complications has introduced a disturbing and conflicting element. It is no longer the strongest, the healthiest, the most perfectly organized. It is not men of the finest physique, the largest brain, the most developed intelligence, the best morale, that are favored and successful in the struggle for existence; rather often those emasculated by luxury and those damaged by want, those rendered reckless by squalid poverty, and those whose physical and mental energies have been sapped, and whose characters have been grievously impaired by long indulgence and forestalled desires. Respect for life has preserved thousands with tainted constitutions, and frames, weakened by malady or waste. "Brains bearing subtle and hereditary mischief in their recesses are suffered to transmit their terrible inheritance of evil to other generations, and to spread it through a whole community." Security for property, with its transmission and enjoyment, has enabled many an unworthy and incapable possessor and inheritor to take precedence over others in many of the walks of life, to carry off the most desirable brides from less-favored though nobler rivals, and make them the mothers of a degenerating instead of an ever-improving race. Thus

both the upper and the lower classes of society are unfitted to carry forward the improvement of mankind. Both marry as early as they please, and have as many children as they please, the rich because it is in their power, the poor because they have no motive for abstinence, and scanty food and hard circumstances do not oppose, but rather encourage procreation. "It is the middle classes, those who form the energetic, reliable, improving element of the population, those who wish to rise, and do not choose to sink, those, in a word, that constitute the true strength and wealth and dignity of nations—it is those who abstain from marriage or postpone it." (Greg.) Mr. Galton also says: "Again, there is a constant tendency of the best men in the country to settle in the great cities, where marriages are less prolific and children less likely to live. Owing to these several causes, there is a steady check in an old civilization on the fertility of the abler classes. The improvident and unambitious are those who chiefly keep up the breed. So the race gradually degenerates, becoming with each successive generation less fitted for a high civilization, although it retains the external appearances of one; until the time comes when the whole political and social fabric caves in, and a greater or less relapse towards barbarism takes place."

Thus the tendency in communities of advanced civilization to multiply from their lower rather than their higher specimens, constitutes one of the most formidable dangers with which that civilization is threatened. The counteracting influences it is to be hoped will be found in the spreading intelligence, the matured wisdom, the ripened self-control, in the social virtues which that civilization nurtures and in which it ought to culminate. (Greg.)

One other cause of the numerical failure of the higher types is to be found in the fact already alluded to by Mr. Galton, on discovering that the children of scientific men are not as numerous as those of their own fathers, namely, that cerebral development tends to lessen fecundity. It would seem, therefore, that herein lies one of the greatest dangers of a high order of civilization. The answer is so admirably given by Mr. Herbert Spencer, in his "Principles of Biology," that we give it in part as quoted by Mr. Greg:

"The necessary antagonism of individuation and genesis not only fulfills with precision the *a priori* law of maintenance of race, from the monad up to man, but insures the final attainment of the highest form of this maintenance, the form in which the amount of life shall

be the greatest possible, and the births and deaths the fewest possible. The excessive fertility has rendered the process of civilization inevitable, and the process of civilization must inevitably diminish fertility, and at last destroy its excess. From the beginning, pressure of population has been the proximate cause of progress. It produced the original diffusion of the race. It compelled men to abandon predatory habits and take to agriculture. It led to the clearing of the earth's surface. It forced men into the social state; made social organization inevitable, and has developed the social sentiments. It has stimulated to progressive improvements in production, and to increased skill and intelligence. It is daily thrusting us into closer contact and more mutually dependent relationships. And after having caused, as it ultimately must, the due peopling of the globe, and the raising of all its habitable parts into the highest state of culture; after having brought all processes for the satisfaction of human wants to perfection; after having, at the same time, developed the intellect into complete competency for its work, and the feelings into complete fitness for social life, the pressure of population, as it gradually finishes its work, must gradually bring itself to an end."

Having thus briefly stated a few of the elements of the great problem before us, what we, as physicians, should be studying is, not merely how to relieve the suffering which comes into the world, and prolong the lives of the wretched and miserable, as well as of the healthy, but how to secure that a larger proportion of those born shall come as of right to the possession of an inheritance of health, long life, energy, well-balanced sensitiveness of organization, self-reliance and enthusiasm, which go to make the difference between one fitted to advance the world in its upward course, and one ever dependent on humanity for even a tolerable existence. Dr. Holmes has said: "There are people who think that everything may be done, if the doer, be he educator or physician, be only called 'in season.' No doubt; but *in season* would be often a hundred or two years before the child was born, and people never send so early as that."

Let us now begin to save a few of the unborn.

What, then, are some of the methods whereby this is to be accomplished?

Man at the present is the outcome of past centuries of animal life upon the earth, the foremost product, "the heir of untold ages and in the van of circumstance." As no naturalist can tell how any

improved species originates, but has learned to seize the happy product, multiply, propagate, and still further develop it, so we should humbly and patiently study the conditions which seem to have produced any marked and noble stock in the human family, perpetuate and nourish the individuals, and encourage them to beget their like by suitable marriages, that their offspring may be a permanent possession on the earth.

Mr. Galton says: "It is hardly necessary to insist on the certainty that our present imperfect knowledge of the limitations and conditions of hereditary transmission will be steadily added to; but I would call attention again to the serious want of adequate materials for study in the form of life-histories. It is fortunately the case that many of the rising medical practitioners of the foremost rank are become strongly impressed with the necessity of possessing them, not only for the better knowledge of the theory of disease, but for the personal advantage of their patients, whom they now have to treat less appropriately than they otherwise would, through ignorance of their hereditary tendencies and of their illnesses in past years, the medical details of which are rarely remembered by the patient, even if he ever knew them. With the help of so powerful a personal motive for keeping life-histories, and of so influential a body as the medical profession to advocate its being done, and to show how to do it, there is considerable hope that the want of materials, to which I have alluded, will gradually be supplied."

Accordingly, he has prepared a "Life History Album," which, with a "Record of Family Faculties," is a veritable *multum in parvo*, so convenient and comprehensive that most intelligent families would be only too glad to have them brought to their notice for prompt and continuous use.

May we not, then, with the aid of these life-histories, arouse in every family an approach to some adequate appreciation of the immense value of the knowledge so acquired, both to the individuals themselves for the right governing of their lives as they come to maturity, and also to guide in the selection of appropriate companions whereby to propagate such qualities as shall most enrich the world?

Instruction may be given to parents and teachers in the matter of the several diatheses, and so children may be taught to recognize and shun that most wide-spread and pernicious one, the strumous, which now destroys more lives than any dreaded plague or pestilence. The

effects of the intermarriage of families and of persons of like temperaments should be pointed out. Simple books in plain, untechnical language, like Fothergill's "Maintenance of Health," which has a chapter on the subject of inheritance, could be placed in the hands of all moderately-educated families. The careful study of Ribot's "Heredity" would greatly profit any intelligent household.

The subject should be insisted on as a vital matter of study in all higher schools in which physiology and hygiene are taught. Happily, many of our State Legislatures are being aroused to the overwhelming importance of the latter subject.

Thus, both in the family life and in the school, the growing youth would be taught to regard themselves as parts of a great system of rational beings, fitted by heredity to carry on certain works, and urged so to adjust themselves to their environment that the best of which they are capable may be accomplished, and the resulting offspring be enabled to start on a slightly higher plane. If physicians and sanitarians will set this before them as the ideal standard up to which the family and the school must be brought, the two most important agencies for the elevation of the race will be won.

In the furtherance of this scheme, likewise we believe that the family physician should be, and if it were properly carried out, would become, more and more the trusted counselor and advisor of those under his charge. Matrimonial alliances would be more especially subjects for his wise and affectionate judgment. If it is the physician's duty, in common with all philanthropists, to protect the helpless, relieve the suffering and prolong the lives of the sick and diseased, it is more imperatively his duty to prevent, by all legitimate means, the birth of such into the world. Thus, he may aid in hastening, as Mr. Greg says, that "day when, as the moral tone of society advances, and men rise to some larger and more vivid perceptions of their mutual obligations, the propagation of vitiated constitutions, as well as of positive disease, will be universally condemned as culpable, and possibly prohibited as criminal. Some classes and communities have already, from time to time, reached this slight rising ground in social virtue, in reference to the three fearful maladies of insanity, leprosy and cretinism. Surely a further progress in knowledge and reflection, and a somewhat wider range of sympathy, may extend the list to scrofula, syphilis and consumption. I can discern no reason, beyond our own halting wisdom and deficient sense

of right, the strange ignorance of some classes, and the stranger senselessness of others, our utterly wonderful aud persistent errors in political and social philosophy in nearly every line, why a very few generations should not have nearly eliminated from the community those who ought not to breed at all, and have taught prudence to those who ought to breed only in moderate and just proportions."

Business enterprises, changes of residence and occupation, with all the complicated effects of climate, food and clothing, and the relative value of new social relations, should be thoroughly discussed by families with the physician. They *will* be when life, in its highest and best sense, becomes "more than food and the body more than raiment."

We can only suggest a few ways in which the specialist may be helpful to society in this work. For example, Dr. J. S. Billings (Art. Hygiene, Pepper's Syst. Med.) says: "The importance of taking into account hereditary influences is well illustrated by the care which is taken to obtain information with regard to them in well-conducted life insurance companies. The medical examiners of such companies have their attention specially called to this matter, and the following extract from a manual of instructions shows how it is regarded from a business point of view: 'If consumption is found to have occurred in the family of the applicant, he is to be regarded not insurable under the following circumstances, viz.:

	Years of age.
If in both parents, not insurable until	40
If in one parent, not insurable until (except for 10 ten-year endowments, then 20 years)	30
If in two members, not parents	35
If in one member, brother or sister (except for 10 ten-year endowments, when peculiarly favorable)	20

"If apoplexy, paralysis or heart disease is found to have occurred in any two members of the applicant's family, he is to be regarded as insurable only upon the endowment plan, the term of insurance to expire prior to his reaching the age of fifty years. If insanity shall have so occurred (in two members), a provisionary clause is essential, and is attached to the policy by the company."

We ask, why should not such facts, the results of long years of work by medical examiners, be more generally published through the press, till the fathers and mothers of the country realize them as

thoroughly as do the directors of insurance companies? If a life is not insurable, what is its marriageble value? What a burden of suffering and unrequited toil, sickness in the progeny and blasted hopes in the parents, will result from the union of such with others equally vitiated!

The hereditary transmission of diseases of the eyes, heart, lungs, nervous system, kidneys, digestive viscera, blood and generative organs should be constantly kept before the profession by specialists, and such facts and figures as may be made comprehensible to the laity should, for their guidance, be given to the press, and so spread broadcast through the land.

We believe that the pulpit should likewise be urged by the medical profession to contribute its share to the general good, in the preaching of a religion of humanity which should condemn disobedience of physical law as equally culpable with infractions of the moral code. In the light of this truth, the reckless imposition of disease, early blight, hopeless wretchedness and premature death upon helpless and inoffending offspring should be regarded and taught as a most heinous crime against man and God. The possession of the globe by a strong and noble race, and its conversion into a paradise, should be regarded as among the legitimate aims of the earthly life, and not merely the speedy transfer of that race to new and untried conditions in a life to come.

We are happy to see that some of the clergy, already aroused to the importanee of this matter, are writing and preaching upon it.

The conclusions at which we arrive, then, from this hasty review may be summed up as follows:

In determining the mental and physical characters and efficiency of man, nature is more potential than nurture. Great powers of body and mind seem to run for generations in families. Early marriages favor the rapid multiplication of those engaging in them. Hence they should be encouraged in the strong, discouraged in the weak.

Defects of constitution descend to posterity even more certainly than their opposites. It becomes man's duty, therefore, systematically to favor the evolution of a higher race. Suitable matrimonial alliances are among the most powerful agencies for the accomplishment of this purpose. In this process the best and strongest races and nations have survived in the past, but civilization has introduced into society elements favoring the rich and the poor, worthless classes; and

the increasing demands of that civilization have made the intellectual less fertile, thus putting a check upon the growth of the best classes in society, which only intelligent and educated forethought can counteract.

Our duties are, then, to cultivate and perpetuate the nobler types of mankind. To do this we should encourage increase of knowledge among families by inducing them to write and study most diligently their life histories, and to govern their family alliances accordingly.

Teachers, also, should be instructed in their value and importance, that schools may become propagators of this class of truths.

The family physician should at once put those under his charge upon their guard as to certain hereditary evils to be avoided, and hold up to view the constitutional qualities more to be desired than wealth and social position.

Specialists should see that the press teems with the facts and figures which show the pitfalls and the prizes of life.

The clergy should be urged to preach that the heavenly life must begin in the right use of the earthly, and that men are best fitted to die when best prepared to live.

INFANT MORTALITY.

Under this division we include all children under five years of age. These can be divided into three classes, viz., those under one month, those between one month and one year of age, and those from one year to five. Those under one month are often spoken of separately, because they so often perish from causes incident to birth, or from disabilities that existed at the time of birth. Those under one year include the suckling period, and are apt to be involved in causes which affect the health of mothers. It is not so important to consider these separately from others under five years of age as it is those who die under one month, since in many respects they fall into the general class, and the special influences between one month and one year can be noted without full numerical comparison.

Deaths as a whole under five years of age are important to be considered separately, (*a*) because they to some degree indicate race vitality; (*b*) because of the large proportionate number that occurs; (*c*) and because so often they are the index of causes of mortality which are preventable and ought to be abated. Deaths that occur under one month so far show imperfect inheritance, or early mismanagement, or ill-intent, that they often need to be inquired into in order to separate these causes.

It is generally not difficult for physicians to determine between those causes of death which are developmental, and those which are diathetic or constitutional; those which occur by carelessness or ignorance of management, and those which are directly from neglect or ill-intent. We separate those under one month because unless these causes are very accurately specified the causes of death assigned are often misleading. Thus, marasmus and diarrhœa are often put down as causes of death for the first month, when these have been but incidents. As the child becomes a little older the special cause of sickness becomes more ascertainable. It is for this reason that in our tables of causes of death, the causes under one month are not added

to the general table unless the death has been caused by some contracted disease.

Deaths of children under one year of age are always analyzed with advantage because they are so numerous and so uniformly show a very marked influence resulting from modes of feeding. Diarrhœa, which is the cause of very many deaths under five years of age, is especially the cause of death to those under one year. In a record of the city of New Haven for five months, from June 1st, 1884, to November 1st, 1884, out of 259 deaths under five years of age 111 were from diarrhœa; all but seven being over one month and more than four-fifths being under one year.

In August, 1885, Dr. Lindsley, the health officer of New Haven, after noticing the death-rate among children from intestinal diseases, says the statement is in exact agreement with the observation of previous summers for several years. It shows how definitely the deaths of the little ones are associated with insanitary conditions about their houses, and it shows with equal force how exempt from fatal intestinal diseases are those fortunate babies who live in houses with good sanitation. There were thirty-two deaths in August from infantile diarrhœa. Of these the homes of only four have not been inspected. Of the remaining twenty-eight we have written reports in the office, and they are as follows: In twenty-seven of twenty-eight there was a privy in use in the yard. In the only case in which there was none the deficiency was supplemented by overcrowding, there being fifteen families in a block of tenements. In twenty-two of the twenty-six there were, in addition to the privies, the densely-local abomination, the cesspool. In six of these the situation was rendered worse by untrapped sinks, and in one other by a leaky drain. In eighteen of these houses well-water was the only supply, and every well was in close proximity to a privy and cesspool, often between the two. There were no other deaths from infantile diarrhœa reported to the registrar in August. Of the thirty-two the homes of twenty-eight have been inspected, and it is on our records that twenty-seven of the twenty-eight were living over privy-vaults and cesspools, and thirteen of them drinking the soakage of these filth-pits from the other hole in the ground called the well. Comment on the above facts seems unnecessary. The most obvious and positive influences which these facts teach is that fatal infantile diarrhœa is limited to those who are exposed to the exhalations of human excrement collected in masses

on the ground, and that the large portion of the population not so exposed are exempt from these intestinal disorders in a fatal form.

According to our last quinquennial record, out of 108,278 deaths 42,345 were under five years of age. Of these 11,768 died of diarrhœal diseases. Those of adults being separately tabulated with diseases of the digestive tract. Of the 42,345 cases 27,704 where in cities of over 5,000 population.

These results are of much value because they agree "with all statistics of the same kind which have been gathered in a large number of places, and through long periods of time by most careful observers." A greater significence arises from the fact that careful investigation shows that artificial feeding greatly increases this death-rate. The New Haven inquiry, made by E. H. Jenkins, Ph.D., is so painstaking, and shows so much ability in making right use of figures and right deductions therefrom, that we cannot do better than quote so much of it as relates to this part of the subject:

"Of the 111 children who died of infantile diarrhœa, 14 were nursed entirely by their mothers, 12 others were nursed less than 1 month, 5 between 1 and 2 months, 2 between 2 and 3 months, 3 between 4 and 5 months, and 3 between 6 and 9 months. 5 were both nursed and bottle-fed, and of 13 cases the particulars are not known. 54 were not nursed at all. That is, out of 98 cases—

14.3	per cent. were children nursed by their mothers.
77.5	per cent. were children bottle-fed wholly or in part from the time they were 2 months old.
8.2	per cent. were children who were longer nursed than the others, but were bottle-fed at the time they were taken sick.
100.0	

"Published statistics generally agree in this, that a large majority of those who die in infancy were fed by hand, that is, were fed in an unnatural way. In those countries where the death-rate of children under one year of age is least (under 15 per cent. of the total number born alive in Norway, Sweden and Ireland), the nursing of children by the mother is almost universal.

"In Lower Bavaria and the Palatinate, where nursing by the mother is the exception, 50 per cent. die under one year old, while in a portion of Upper Bavaria, where all the children are nursed, in spite of poverty and a harsh climate, only 25 per cent. die. A recent English writer states that 'it is a well-known fact that during the Lancashire famine, when no work was to be had, the infant mortality rate fell considerably, in spite of decreased earnings.' 'In Coventry

the diarrhœal death-rate among children, due to improper feeding, has been shown to vary considerably, and in proportion to the prosperity of trade, being reduced two-thirds when the trade was at the slackest and the mothers consequently thrown out of employment.'

"This English writer, F. E. Atkinson, Medical Officer of Health, voices the nearly unanimous opinion of medical authorities when he says, 'I believe there are very few cases where a child cannot be nursed by its own mother. Refusal to nurse in the working classes is caused by the necessity of the mother's working.' It has been proposed in England that the employment of women in factories within a year after the birth of a child should be prohibited by law. In Belgium, where the government has established public nurseries for the care of the children of working women, the death-rate among infants is lower than in any other country. This is largely due, no doubt, to the better care which the children receive at the nurseries, and especially in the matter of feeding.

"The special dangers to which a child is exposed who is brought up by hand are manifold. In the first place, cow's milk at the best cannot be made to have the same chemical composition as mother's milk, with any amount of domestic doctoring; it is at best a food not fully suited to the needs of the infant. This unnatural food must be assimilated, too, while the digestive organs are imperfectly developed, and in a particularly sensitive condition.

"Again, milk is known to be a common channel for distributing zymotic diseases. Living germs find in milk a most suitable breeding-place, and if it is exposed at all to the emanations or germs from any decomposing matter—and how difficult it is to avoid this under the most favorable circumstances housekeepers can testify—it will itself receive, multiply and transmit them.

"If the milk is watered by the seller with impure water, or if his cans are washed in impure water, or if the milk after it is delivered to the family is diluted for the babe with bad water, or if it suffers contact with any noisome substance or emanations, there is great danger to the child.

"Sometimes to the milk is added arrow-root or other farinaceous matters. If these are used in early infancy, before the secretion of saliva and the pancreatic fluid are begun—which alone render the assimilation of starch possible—they are of no use to the child, and if they have any effect at all it is only as irritants in the intestinal canal. Cless ascribes the high rate of infant mortality in Würtemberg (45 per cent. in the first year) to improper feeding. Its cause is 'the infant-murdering Swabian meal porridge, the chief and favorite food for the nurslings of our rural population, the exact opposite of all that which furnishes an appropriate and healthful food for the new-born child, about the worst thing which human ignorance could devise as food for an infant.' (Cited in Conrad's Jahrbücher, Jan., 1882, p. 21.)

"The nursing-bottle itself is too often an abomination and the cause of infantile diarrhœa. The perfect cleansing of the bottle and its tubes would tax the skill and patience of a person quite used to the handling of such apparatus. A chemist finds it difficult to cleanse for chemical uses the interior of a small glass or rubber tube. Too often, for more important uses, the nursing-bottle with its tube is wholly neglected or simply rinsed out, and left with more or less milk and other matters adhering, which soon begin to decompose and spoil or poison the food afterward drawn through it.

"In a word, the odds are enormously against the child who is brought up by hand.

"In most cases the artificial food supplied to these infants who died was either cow's milk or condensed milk or a mixture. Thus, of the 84 infants who had been bottle-fed, 35 had fresh cow's milk, 24 had condensed cow's milk, 7 had a mixture of these or alternately one or the other, 2 had goat's milk, and the rest had various 'prepared foods' with milk."

The importance, as a rule, of reliance upon the natural method of feeding young children is thus plainly demonstrated. Where for good and sufficient reasons this cannot be done, it becomes very important that we know the very best substitutes to be used and the method of using them. We think it can be claimed that the most valuable information on this subject has, after careful experimentation, been furnished by Prof. Albert R. Leeds, of this Board. We refer to his papers on this subject in the sixth and ninth reports of this Board.

"If even the malted foods be used in large relative proportion in early infancy, to the exclusion or great diminution of the quantity of fresh milk, we believe that serious risk is incurred in the direction of scurvy; and this is the more insidious because the body-weight may certainly increase, and the stools may be less offensive and less frequent than under a milk regimen. The proper use of the *malted foods* is that they should be employed in small quantity—not in any sense as a substitute for fresh milk, but as an aid to the digestion of the casein."

Next to this influence of improper feeding, must be placed that of *foul household air*. From this the children of the lower classes, after one year, often in part escape by spending much of the day-time in the street. But the young infant, both by day and by night, is exposed to this depressing influence. In the United States we do not suffer as much from causes connected with the factory labor of mothers, as they

do in Great Britain and some continental cities. But we suffer more from tenements, from excessive heat, and from that form of diarrhœa known as cholera infantum, which is scarcely known abroad. No one can study the mortality statistics of New York and Washington without seeing how great this excess is. It is followed too closely by Boston, Philadelphia, Baltimore, Chicago, St. Louis, and other crowded populations. The mortality for the second year presses quite closely upon that of the first, because children are so often exposed to the same class of causes.

Indeed the perils of the second year are greater in our own country than in most foreign cities. For all children between one and five years of age, a mixed and unsafe diet is far more common than abroad. Our profusion of fruits and vegetables, and the habit of allowing small children to eat at the family table and to indulge in its varieties, has a marked influence upon our infantile death-rates.

Children who have to depend on plain bread and some form of broth, may not seem to be so grandly nourished, but generally fare far better than those who are allowed to partake of great varieties of food. A close observer, who has been studying the infant mortality of New York City, recently said to us that in his opinion, the mortality among young children of over one year of age was more due to their free access to the general table and their too great variety of fruits, than to the impure milk to which it is so often attributed. The children of wage-workers are not generally provided with milk to drink, but depend much on cheap vegetables and a mixed diet. There is great need in our cities, to look after the markets and the hucksters, or venders of stale fruits and vegetables in the more crowded streets. We only need to compare the average infant mortality of country and city, and even of one part of a city with another, and especially during the summer months, to appreciate how much of artificial death there is in the world. Improper foods, foul air, crowded and filthy homes, insufficient air-space and light-space, and individual uncleanliness, combine to give these spots a death-rate greatly in excess, and with it to cause misery, and poverty, and crime, of which the number of deaths is only an imperfect index.

There are those who have come to look upon such deaths as the natural limitation of fecundity, and so a conservative part of the necessary order of things. The old adage, that the good die young, is supplanted by the equally erroneous one of the survival of the fittest.

It is still a fact that while here and there the death of an individual child may be a blessing, that only that political economy is correct which proceeds on the basis that avoidable death is an evil to the State, that the interests of the State require a system which aims at the preservation of the life and the health of those born into the world. It is a very significant teaching of history, that nations begin to die from loss of numbers, or loss of physical stamina, before they begin to die from direct political and moral causes.

The writer above referred to has so aptly presented this and other points connected therewith that we commend this further statement to the attention of all who, as patriots and citizens, as well as philanthropists, would conserve the welfare of the people.

"The death of any one who has not reached the age for working, producing and helping in society, but who has the possibility of all this within him, appears in itself considered a loss to society. An infant who has cost pain and care and labor which would otherwise have been immediately remunerative to his parents, whose chances of life are increasing each day at a very rapid rate, and who then fails and dies, is a loss to his parents and to society. He has been an expense; he might have repaid it by taking his parents' place in the world, but he died insolvent.

"Now it cannot be asserted that these children who die would or would not have been a help to society if they had lived. It is morally certain that some of them would have been only a hindrance. A certain number would have been drunkards, rakes, or paupers, and would have gone from the alms-house to the hospital, and from the hospital back to the alms-house and in the end to the potter's field.

"Possibly one will conclude, all things considered, that the world has lost no more than it has gained by these deaths, and that both the infants and the survivors are to be congratulated. In fact, the subject is often dismissed in this way: 'Poor things! They are saved a great deal of misery. Many of them were children of the very poor and the vicious. They are better dead than alive.' Now this is all very true and *very narrow*.

"The statistics given are chiefly important, not for what they tell of those who are buried, but for what they indicate of those who are living; not as a tale of past misfortune, but of present misery and future woe; distress in which either those who are now in comfortable condition, or their descendants, will surely have a share.

"These deaths mean also a large number—many times that number—of sicknesses. They mean that the same things which destroyed so many have poisoned and crippled others so that they will lead lives of discomfort to themselves and their neighbors by reason of more or less enfeebled constitutions. They mean that many are growing up to

be kept from starving or dying of disease by the money which the more thrifty are working to earn.

"More than this; these deaths mean that as a result of overcrowding, uncleanliness and improper feeding, many have enfeebled nervous organizations which constantly crave stimulant and excitement to rouse them from their usual state of depression and which render them an easier prey to the attacks of moral evil. Drunkenness and lust will gather many victims who were saved from death in infancy and who will scatter the seeds of depravity and disease wherever they and their offspring go.

"They mean besides that during the prevalence of epidemics such as cholera, yellow fever, or typhoid, the places where nearly all these infant deaths occurred, and where, as has been shown, uncleanliness prevails, will be localities of special danger to the whole city, becoming centers from which the diseases will spread. At such times no places however clean will be safe while near them are these plague spots, the recruiting stations of disease.

"They mean once more that in the houses which are no homes by reason of filth and intemperance, social discontent and thoughts of revolution will live as they cannot live in real homes. 'Of a truth,' says a recent writer, 'the matter of house accommodation for the poor is the question of questions both for philanthropists and for statesmen, as here are the breeding dens of the roughs of all countries, nations and tongues.' * * *

"Nothing is more certain than that these deaths and the things which cause them and which at the same time help largely to fill our hospitals, alms-houses and jails, are to a large degree preventable, and to prevent them, or rather to do away with the causes that led to them, is the aim of all public sanitary effort and legislation.

"This endeavor is largely prompted by self-interest. If men will not help others out of ignorance and filth for the others' sakes, they must do it to some extent for their own sakes, in order to preserve the social fabric. The public knows that it cannot afford as a matter of dollars and cents, to be visited by such a scourge as yellow fever or cholera often has been. So when such a disaster is felt to be imminent, it is easy to secure attention and an appropriation for a spasmodic effort at cleanliness, for the removal of filth-pockets that have been poisoning the public for months and years unheeded. But in the absence of any immediate and personal peril it is not so easy to see that the mere destruction of lives, shocking as that is, is not the thing most to be dreaded; that the slow undermining of the health of a portion of the community by foul air and water and soil and improper food, the development of ill-regulated appetites fostered at least by the same things, the loss of self-respect and of hopefulness which are certainly attendant evils, that all these are things more terrible to those who immediately suffer, and in the end to society itself, than loss of life by war or sudden pestilence.

"The question of the removal and destruction of filth is the most serious question of the day. The 'conflict of civilization with its own wastes' is still a doubtful one.

"It is not the purpose here to describe in detail the way by which a happy issue out of the present state of things is to be secured. The golden age is not to be brought again wholly by sanitation. There is trouble with all of us because of disregard of eternal laws vastly wider in their bearing than those which govern the health of our bodies. But a great need of all of us, without exception, is education in sanitary matters. To teach children, and adults as well, the knowledge and practice of personal and public hygiene, will work most efficiently towards eradicating all of that intricately correlated group of evils, poverty, squalor, disease, intemperance and lust, every member of which is an effect as well as a cause.

"Such education will create a public sentiment which will demand legislation on matters wherein the State and city, for their self-preservation, have a right to legislate, and will enforce it. It will teach builders and house-owners that it is for their own interest to construct homes and not death-traps for their tenants, and it will help to make tenants, even the poorest, appreciate what is done by landlords in this direction and understand that their lives to a great degree are in their own hands, and that the penalty of carelessness in regard to their persons or their premises is misery and death."

CLIMATOLOGICAL OBSERVATIONS AND RECORDS.

Meteorology and Climatology have so prominently taken their place among practical studies that there is no longer need to make special argument for the collection of facts as to them. But like any voluntary service requiring time and skill, there are many practical difficulties in the way of securing complete returns. As an evidence of this, no one of the colleges of the State has kept a record at all complete, and dependence has had to be placed upon the careful citizen who, either from leisure or taste, chooses to act as clerk of the weather.

As the relation of the work of this Bureau to these records is technical, and only for the purpose of studying the effect of climatological conditions on the local health, we selected stations and observers, both in reference to certain positions of latitude and longitude, to relations of water-site and to the geological divisions which the State admits.

The addition of observations at Newton, and the securement of the aid of former or new observers at various chosen points, afforded the desired comparisons. Owing to some change in the stations in the signal service, we are not able to give as fully as usual the records at Barnegat and Cape May. Observers for the year have been:

Newton—Miss E. Foster.
Paterson—Wm. Fergason.
Newark—F. W. Ricord.
New Brunswick—P. Vanderbilt Spader.
Beverly—C. F. Richardson.
Sandy Hook—U. S. Signal Service.
Vineland—C. H. Adams, M.D.
Barnegat—U. S. Signal Service.
Cape May—U. S. Signal Service.

As the chief signal officer of the army has recently organized a State Weather Service for this State, and started a monthly paper known as the *N. J. Weather Chronicle*, we hope hereafter to have a record which will give all those details which will aid in yearly and still more in quinquennial comparisons.

DEPRESSING WEATHER, AND SOME OF THE CAUSES WHY WE ARE AFFECTED BY THE WEATHER, OR WHY CHANGE OF CLIMATE IS SOMETIMES ADVANTAGEOUS.

Weather has so much to be taken into account in relation to health that it is well for us to recognize some of the effects which it may have on health and on disease. While we cannot change the weather, we have great powers of adaptation thereto, and it is in the wise exercise of our relations to it that we receive many benefits and avoid many evils. A recent writer thus briefly outlines the subject:

"There are manifestly three particulars of the general effect of depressing weather that may be usefully studied apart. Thus: The effect produced by external conditions on the temperature of the body, at the surface at least; the effect on the blood-pressure generally and the air-pressure in the lungs; and the effect on the nerve-state, with the secondary influences exerted on or apparent in the tone of the muscular system. It is, of course, impossible to go into these matters at all in detail. Suffice it to make the following observations by way of suggestion: If the surroundings be such as to abstract heat without at the same time stimulating the organism to a greater or quicker 'evolution of caloric'—to use an obsolete but convenient expression—there must needs be a gradual lowering of the vital heat on which, as we know, the energy depends. Although it would not be accurate to assert that the convertibility—for convenience of expression—of the terms *heat* and *force* in relation to the organism implies that these two forms of motion are actually correlative, it is nevertheless a fact, that where there is any defect of bodily heat by reason of deficient production, there is sure to be 'depression' as a consequence. As a matter of experience, we know the difference from feeling cold as a healthy man may feel it in bright weather, without the least loss of energy, but rather a quickening and enlivening of the animal spirits; and 'feeling cold,' as it is felt when the life seems to be chilled and the heart sinks with oppression and misery, the very 'mind' and 'senses' being, as it were, numbed. This subjective difference between the two states is due to the deficiency of bodily heat resulting from different causes: on the one hand, rapid abstraction by the surroundings with stimulation, as on a bright cold day; and, on the other hand,

loss of heat without stimulation when the surroundings are cold without being invigorating. Another point of moment as regards heat relates to the manner in which it is distributed. The temperature of the blood may, as is well known, vary, under different conditions of the body-state, in the several vessels, from 98.6° Fahr. near the surface, to a much higher point in the deeper parts. The surface temperature is generally below the figure stated, and immediately underneath the skin it probably often falls to a point still lower, just as it may rise in certain maladies—*e. g.*, erysipelas or scarlet fever—to a temperature at the surface far above that in the deeper vessels. Obviously, if there be a tendency to depression of the nervous tone, any disturbance of equilibrium between the surface and the deep parts of the organism must be embarrassing, and therefore exhausting, when there is no proportionate stimulation or excitation of the heat-producing faculties and processes. Blood-pressure and air-pressure, both together and apart, are important factors in the general state, and are physically and chemically influenced by the weight, temperature and oxidation of the atmosphere. The nervous system is acted upon through the mind and senses, and—which is too often forgotten—by the *electrical state* of the earth and our surroundings generally. There seems reason to suppose that a 'heavy,' 'depressing' state of the environment means, in part at least, a condition in which electricity is absorbed from the earth and held in the clouds at the periphery of the *practical* atmosphere, with the result that the earth, or a portion of it, and the organisms upon it, are deprived of their normal residuum of static electricity, as before a thunder-storm, the electricity being regained only after 'the storm that clears the air,' to use a popular expression, when, in fact, the electric fluid has been returned to the earth in the form of lightning, or been carried back to it by the rain. 'Depressing weather' is a state, or a number of states, in which an effect, in great part physical and in lesser part mental, is produced on the animal organism through the media of temperature, blood-pressure and air-pressure, nerve tone and electrization. Some organisms are more susceptible of external impressions than others, and these are the most susceptible of the injurious influence which depressing weather exerts. The indication with a view to self-defence or remedy is obviously to render the mind and body as little responsive as may be to external conditionings, by giving it a force and momentum of its own. This force and momentum are only to be created by voluntary energy and healthful exercise."

METEOROLOGICAL SUMMARY OF VARIOUS STATIONS FROM JULY 1ST, 1885, TO JULY 1ST, 1886.

STATION, DENNIS LIBRARY, NEWTON, N. J.

Latitude, 41° 2′ 45″ N.; Longitude, 2° 19′ 48″ E. Height of Barometer Cistern above Sea Level, 660 feet.

OBSERVER, MISS E. FOSTER.

	BAROMETER. Reduced to 32°.			THERMOMETER.																
	Max.	Min.	Mean.	Max.	Min.	Mean.	Mean Daily Range.	Mean Humidity.	Prevailing Wind.	Rain (Inches).*	Snow (Inches).	Days when Precipitation equaled 0.01.	Cloudy Days.	Rain-fall on Days.	Thunder and Lightning on Days.	Snow-fall on Days.	Fog.	Hail.	Frost.	Lunar Halos.
1885.																				
July	29.466	28.917	29 218	100.0	49.1	76.15	21.8	63.63	S.W.	4.25	....	14	2	14	8	....	....	....	....	1
August	29.495	28.913	29.230	91.0	46.0	70.04	19.1	70.83	S W.	8 90	....	14	6	16	12	....	1	....	....	3
September	29.614	28.704	29.301	82.0	42.0	62.14	19.8	66.55	S W.	0.77	....	6	5	7	3	....	3	....	....	3
October	29.526	28.474	29.305	76.9	30.3	62.07	17.9	69 67	S W.	5.02	Trace.	10	11	11	2	1	6	1	7	1
November	29.578	28.736	29.141	69 8	19.5	43 29	13.4	69.35	N. E., S.W.	5.31	14.0	11	11	9	1	5	....	....	11	3
December	29.909	28.427	29.202	57.0	9.7	33.89	14.2	69.15	S W., N.W.	3.08	1.0	13	7	7	....	7	1	....	26	5
1886.																				
January	29.976	28.082	29.226	59.4	-3.3	25.32	11.5	70.23	N. E., N.W.	3.95	21.0	15	12	9	....	9	....	....	26	3
February	29.752	28.562	29.251	59.6	-7.0	28.01	18.0	62.15	S W.	4.13	6.5	11	8	6	....	8	5	....	23	2
March	29.672	28.551	29.133	67.0	2.0	36.39	16.3	61.02	N.W., S.	4.09	2.0	13	10	11	4	8	1	2	18	2
April	29.777	28.672	29.329	86 0	26.5	54.28	23.3	59.94	N. E.	3.11	4.5	8	6	8	2	3	....	....	5	1
May	29.544	28.801	29.147	87.0	40.0	60.13	22.6	62.04	S.W., N W.	6.42	....	18	9	19	6	....	1	....	1	....
June	29.526	28 753	29.212	88.0	45.6	67.35	21.7	63.10	S., N.W.	2.68	....	9	4	9	1	....	1	....	1	2
For the year	29.653	28.632	29.224	76.89	25.03	50 75	18 7	64.80	S W.	51.74	49.0	142	91	126	39	41	17	2	118	26

*Including melted snow.

REMARKS.—July, 1885—Marked for its intense and prolonged heat. From the 16th to the 26th, the mean temperature was 81.57°. Thunder storms frequent. There was delightful dryness of atmosphere, the weight of vapor from noon till midnight being reduced to a minimum. August—Mean temperature 1.80° below the average. Rain on sixteen days to the amount of 8.90 inches. This great excess is due to the heavy rain of the 3d. In the three and one-half hours preceding midnight, the rain-fall was 6.42 inches, nearly three-fourths of the total monthly fall. There is no record of any such rain-fall in Newton since the cloud-burst, which occurred in May, 1876. Cellars were flooded, even in the highest parts of the town. The level of ground-water was three feet from the surface. Immediately following this, cholera morbus, dysentery and diarrhœal troubles prevailed. Three cases of typhoid fever (one fatal); bronchitis was prevalent, and there was one death from laryngitis. The summer rain-fall was 2.06 inches greater than in 1884. September—Temperature was 3.5° below the average. Rain-fall the least for any corresponding month on our records. Exceedingly dry, but no suffering from drought, the rain-fall of August having saturated the ground to a high level. From the 15th to the close of the month, relative humidity was low. Dysentery and several cases of typhoid fever developed at the beginning of the month. Remarkably free of sickness after the 10th. October—Temperature was genial and uniform. First frost on the 7th. Fogs were frequent. Rain-fall nearly an inch above the average. One death from diphtheria. November had raw, chill atmosphere. Temperature was 1.43° above the mean. The water-fall was two and a half inches in excess of the average. Whooping-cough, measles, chicken-pox and rheumatism prevailed. Autumn, 1885—Mean temperature 1.35° lower than that of 1884. Rain-fall was 2.05 inches in excess. December—The month was free from the intensities at or below zero, by which even our warmest Decembers have been characterized. Mean temperature was 2.0° above the average. There was an absence of snow on the ground, and an unusually large number of rainless days. The year closed with no frost in the ground. On the 13th, following a very rapid fall in the barometer, several persons had attacks of vomiting and purging. The level of ground-water was high. January, 1886, falls below the average temperature 1.16°. No frost in the ground at the beginning of the month, and temperature much above the normal. After the 6th there were marked cold periods lasting 5 or 10 days, which, for intense and prolonged frigidity, have not been exceeded in former years. First heavy snow storm of winter came upon the 9th, and was accompanied with high wind, causing severe drifts. On the morning of the storm, the barometer indicated 28.082 inches, the lowest reading on record here, and having made the remarkable fall of 1.12 inches since the previous evening. Tonsilitis and influenza prevailed. February was fickle and delusive. The 5th, with an average temperature of −0.17°, was the coldest day of winter. The continuous northwesterly gale from the 26th to the 28th, with the temperature between 5 and 22°, was very trying to the human organism. The daily range was wide and unequal. There were cases of scarlatina, tonsilitis and pneumonia during the latter part of the month. Winter, 1885-6—Temperature 2.65° above the mean of 1884-5. Rain-fall 3.32 inches less, and depth of snow 26 inches less than in 1884-5. March—Temperature 1.61° above the normal. The intense cold of the first days of the month was made more unendurable by the northwesterly gale, which did not subside until after the 5th, having lasted eight days. Scarlatina and tonsilitis prevalent. April—Dry and warm, mean temperature being 5.02° above the average. Cellars were flooded from the heavy rain of the 5th. Level of ground-water, two feet from the surface. Several cases of diarrhœa followed rapid fall in barometer on the 5th and 6th. May—Rain-fall 3.36 inches above the average. Cellars flooded on the 7th and 8th. Spring, 1886—Mean temperature 5.15° higher than in 1885. The rain-fall exceeds that of 1885 by 6.99 inches. June—Temperature was uniform, though 1.98° below the average. Daily range was wide and very equable.

STATION, PATERSON, N. J.

Latitude, 40° 55′ N.; Longitude, 74° 11′ W. Height of Rain Gauge above Sea Level, 142 feet.

Observer, William Fergason, City Surveyor.

	Barometer. Reduced to 32°.			Thermometer.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (inches).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1885.												
July	......	......	......	96	58	77.	......	S. W.	3.85	......	8	......
August	......	......	......	90	52	71.	......	S. W.	6.48	......	12	......
September	......	......	......	83	50	64.	......	S. W.	0.64	......	4	......
October	......	......	......	72	39	56.	......	E. & S.	5.47	......	8	......
November	......	......	......	70	27	46.	......	N W.	5.17	3	8	......
December	......	......	......	55	17	36.	......	N. W.	3.28	2	5	......
1886.												
January	......	......	......	47	2	27.	......	E. & N.	4.65	4	12	......
February	......	......	......	58	0	30.	......	N. W.	5.42	2	9	......
March	......	......	......	65	13	37.	......	N. & N. E	3.84	1	10	......
April	......	......	......	85	33	49.75	......	W. & S. W.	3.65	2	6	......
May	......	......	......	87	40	61.	......	S. W.	5.94	......	13	......
June	......	......	......	84	46	66.	......	S. W.	4.26	......	9	......
For the year	......	......	......	......	......	......	......	......	52.65	14	104	......

* Including melted snow.

STATION, NEWARK, N. J.

Latitude, 40° 44′ N.; Longitude, 74° 10′ W. Height of Barometer Cistern above Sea Level, 53 feet.

Observer, F. W. Ricord.

	Barometer. Reduced to 32°.			Thermometer.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1885.												
July	30.200	29.760	29.980	99.00	58.00	78.05	......	E.	3.110	......	8	13
August	30.180	29.730	29.955	94.50	52.00	73.36	......	E. & S. E.	5.980	......	12	15
September	30.350	29.600	30.060	86.00	44.00	66.00	......	S. E., S. W.	0.510	......	4	9
October	30.280	29.290	30.021	75.00	35.00	55.67	......	E. & S. E.	4.470	......	8	16
November	30 320	29.600	29.934	71.00	29.00	46.95	......	S. E. & W.	4.770	......	7	22
December	30.680	29.270	30.001	57.00	10.00	36.24	......	N.E., N.W.	3.100	3	8	20
1886.												
January	30.780	28.800	30.006	55.00	2.00	29 18	......	N.W., S.W.	4.960	4	12	17
February	30.520	29.400	30.066	52.00	†-2.00	30.00	......	N.W., S.W.	4.670	2	6	16
March	30.480	29.350	29.939	62.00	10.00	38.74	......	N. W.	3.950	2	9	17
April	30.550	29.460	30.124	84.00	32.00	53.33	......	N., S. W.	4.170	2	6	18
May	30.300	29.500	29.923	87.00	43.00	61.16	......	N.W., S.W.	7.130	......	11	18
June	30.270	29.520	29.980	84.00	53.00	68.91	......	S. E., N. E.	3.194	......	8	14
For the year	......	......	......	......	......	......	......	......	......	......	......	......

* Including melted snow. † Below zero.

Remarks—Partially-cloudy days are here counted as cloudy.

STATION, NEW BRUNSWICK, N. J.

Latitude, 40° 29′ N.; Longitude, 74° 26′ W., or 2° 37′ E. Height, 115 feet.

OBSERVER, P. VANDERBILT SPADER.

	Barometer. Reduced to 32°.			Thermometer.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1885.												
July	......	......	......	94	56½	......	......	......	4.29	......	11	......
August	......	......	......	87	50½	......	......	......	5.30	......	14	......
September	......	......	......	83	44	......	......	......	0.60	......	6	......
October	......	......	......	72	36	......	......	......	4.00	......	11	......
November	......	......	......	70½	28	......	......	......	4.04	......	12	......
December	......	......	......	60	15	......	......	......	2.72	......	6	......
1886.												
January	......	......	......	56½	......	......	......	......	4.16	......	16	......
February	......	......	......	62½	-1	......	......	......	4.94	......	9	......
March	......	......	......	66½	12	......	......	......	3.95	......	12	......
April	......	......	......	79	29	......	......	......	3.57	......	7	......
May	......	......	......	80	43	......	......	......	5.30	......	15	......
June	......	......	......	79½	53	......	......	......	4.06	......	9	......
For the year	......	......	......	......	......	......	......	......	47.13	......	128	......

*** Including melted snow.**

ANNUAL SUMMARY OF OBSERVATIONS AT BEVERLY, N. J., FOR THE YEAR ENDING JUNE 30th, 1886.

SENT BY C. F. RICHARDSON.

Months.	Mean Barometer.	Temperatures.			Mean Relative Humidity.	Total Rainfall and Melted Snow.	Rainfall on Days.	Thunder and Lightning on Days.	Prevailing Wind.	Remarks.
		Mean.	Maximum.	Minimum.						
1885.										
July	......	77.25	100	60	......	2.75	8	10	N. W.	......
August	......	72.25	95	50	......	6.83	12	17	N. W.	......
September	......	64.22	87	46	......	1.69	7	3	S. W.	......
October	......	53.80	78	34	......	3.51	11	3	N. W.	First frost on 5th.
November	......	44.32	73	26	......	3.59	10	......	S. W.	......
December	......	35.03	60	10	......	2.80	6	......	W.	......
1886.										
January	......	26.69	57	-4	......	4.20	11	......	N. E.	14 inches snow fall.
February	30.13	28.29	62	-3.5	......	4.58	8	......	N. W.	12.7 inches snow.
March	30.06	38.50	68	12	75.2	3.64	11	2	N. W.	......
April	30.24	50.64	85	30	72.8	5.48	10	3	N. E.	Last frost on 9th.
May	30.12	58.05	83	46	74.3	8.06	15	8	N. W.	......
June	30.22	67.75	90	52	75.1	3.83	8	4	N. W.	......
Sums	150.77	616.79	......	......	298.0	50.95	117	50	......	......
Means	30.15	51.4-	......	......	74.5	4.24	9	......	N. W.	......

STATION, VINELAND, N. J.

Latitude, 39° 29′ N.; Longitude, 75° 1′ W. Height of Barometer Cistern above Sea Level, 105 feet.

OBSERVER, O. H. ADAMS, M.D.

	Barometer. Reduced to 32°.			Thermometer.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1885.												
July	30.116	29.719	29.891	100.5	58	78.84	65.63	S.W., N.W.	1.291	......	6	5
August	30.098	29.632	29.879	92.0	56	69.29	72.82	N.W., S.W.	5.110	......	11	10
September	30.232	29.511	29.905	93.0	50	66.67	75.74	S.W.	.604	......	3	5
October	30.140	29.501	29.892	77.0	34	54.66	74.41	S.W.	5.829	......	7	6
November	30.218	29.499	29.783	74.0	30	45.70	76.04	S.W.	4.008	......	8	11
December	30.532	29.201	29.991	60.0	10	35.23	70.22	S.W., N.W.	3.477	......	4	10
1886.												
January	30.680	28.821	29.957	60.0	-2	27.98	74.58	N.W., N.E.	4.270	3	7	12
February	30.384	29.278	29.912	60.0	-10	30.96	68.98	N.W., S.W.	5.938	2	7	10
March	30.142	29.254	29.742	66.0	15	40.31	72.33	N.W., S.W.	3.806	......	9	9
April	30.352	29.317	29.984	73.0	32	53.90	70.63	N.E.	2.517	......	5	6
May	30.185	29.553	29.848	84.0	42	62.42	78.93	N.E., S.W.	4.852	......	14	12
June	30.146	29.320	29.898	86.0	55	70.03	78.81	N.E., N.W.	2.261	......	5	6
For the year.	30.267	29.343	29.885	100.5	-10	52.99	73.09	S.W.	43.966	5	89	102

* Including melted snow.

STATION, SANDY HOOK, N. J.

Latitude, 40° 28′ N.; Longitude, 74° 0′ W. Height of Barometer Cistern above Sea Level, 28 feet.

OBSERVER, U. S. SIGNAL SERVICE.

	Barometer. Reduced to 32°.			Thermometer.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1885.												
July	30.196	29.689	29.951	96.7*	58.4	73.7	77.2	S.	3.54	....	9	1
August	30.252	29.670	29.961	90.4	64.9	71.8	78.0	S.E.	5.48	....	15	6
September	30.379	29.395	30.046	85.0	46.5	64.7	82.9	S.E.	0.58	....	5	3
October	30.282	29.158	29.997	75.0	36.1	55.3	85.1	N.W.	3.32	....	10	6
November	30.344	29.550	29.915	72.0	29.9	46.2	78.2	N.W.	4.83	....	10	10
December	30.701	29.192	29.985	60.1	16.1	37.0	76.0	N.W.	4.33	1	9	6
1886.												
January	30.808	28.771	30.018	52.1	4.1	28.8	78.2	N.W.	4.47	5	14	7
February	30.509	29.212	30.029	55.5	-2.2	28.7	79.1	N.W.	6.53	4	9	2
March	30.497	29.297	29.902	60.1	9.1	36.8	77.6	N.W.	5.27	1	14	6
April	30.529	29.397	30.077	80.0	31.0	48.7	79.8	E.	5.06	1	14	6
May	30.317	29.552	29.884	86.1	45.5	57.9	79.0	S.W.	8.46	....	19	10
June	30.281	29.483	29.938	82.0	52.9	64.9	82.2	E.	4.00	....	13	6
For the year.	30.808	28.771	29.975	96.7	-2.2	51.2	79.4	N.W.	55.87	12	141	69

* Including melted snow.

STATION, BARNEGAT CITY, N. J.

Latitude, 39° 46′ N.; Longitude, 74° 6′ E. Height of Barometer Cistern above Sea Level, 22 feet.

OBSERVER, U. S. SIGNAL SERVICE.

	Barometer. Reduced to 32°. Max.	Min.	Mean.	Thermometer. Max.	Min.	Mean.	Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
1885.												
July	30.187	29.688	29.917	92.2	56.2	73.7	82.8	S.W.	1.90	.....	7	1
August	30.246	29.677	29.958	89.2	52.2	72.7	82.5	S.	6.14	.....	15	7
September	30.369	29.401	30.047	82.1	43.2	64.8	81.2	N.E.,S.W.,W.	1.38	....	7	4
October	30.292	29.095	29.989	74.2	35.7	56.7	85.8	W., N.W.	3.50	.....	10	5
November	30.330	29.547	29.919	64.6	31.2	47.1	83.2	W.	4.89	.....	14	9
December	30.722	29.228	29.996	56.0	14.1	38.0	80.1	N.W.	0.61	1	9	8
For the year	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....

* Including melted snow.

REMARKS.—Station closed December 31st, 1885.

STATION, CAPE MAY, N. J.

Latitude, 38° 56′ N.; Longitude, 74° 58′ W. Height of Barometer Cistern above Sea Level, 27 feet.

OBSERVER, U. S. SIGNAL SERVICE.

	Barometer. Reduced to 32°. Max.	Min.	Mean.	Thermometer. Max.	Min.	Mean.	Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
1885.												
July	30.126	29.671	29.934	88.5	61.0	74.1	85.2	S.	1.57	.....	5	3
August	30.206	29.606	29.937	88.1	53.5	73.8	79.4	S.E., S.	3.47	.....	7	6
September	30.320	29.388	30.034	83.0	52.1	65.9	76.5	S.	0.81	.....	5	7
October	30.325	29.123	30.008	76.4	39.0	58.2	77.5	N.W.	2.99	.....	8	6
For the year	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....

* Including melted snow.

REMARKS.—Station closed October 31st, 1885.

NUMBER OF MARRIAGES, BIRTHS AND DEATHS, BY TOWNSHIPS.

FOR THE YEAR ENDING JUNE 30, 1886.

ATLANTIC COUNTY.

	M.	B.	D.
Absecon	9	13	5
Atlantic City	99	205	167
Buena Vista	....	15	12
Egg Harbor City	29	41	29
Egg Harbor Township	26	81	56
Galloway	4	35	30
Hamilton	17	29	22
Hammonton	16	53	37
Mullica	4	12	7
Weymouth	3	11	6
	207	495	371

BERGEN COUNTY.

	M.	B.	D.
Englewood	30	54	72
Franklin	21	34	30
Harrington	9	43	25
Hohokus	19	55	38
Lodi	32	83	73
Midland	1	22	25
New Barbadoes	40	101	98
*Orvil	....	4	....
Palisade	22	42	24
Ridgefield	19	77	53
Ridgewood	11	26	18
Saddle River	7	28	24
Union	12	71	62
Washington	10	62	45
	283	702	587

* New Township.

BURLINGTON COUNTY.

	M.	B.	D.
Bass River	8	17	12
Beverly	22	19	58
Bordentown	29	100	98
Burlington	83	140	165
Chester	28	56	85
Chesterfield	14	23	14
Cinnaminson	18	64	18
Delran	11	23	10
Eastampton	....	19	5
Evesham	9	27	16
Florence	6	41	22
Little Egg Harbor	11	51	30
Lumberton	1	13	3
Mansfield	10	37	25
Medford	11	39	37
Mt. Laurel	2	18	12
New Hanover	13	57	36
Northampton	60	86	94
Pemberton	13	42	40
Randolph	1	6	4
Shamong	1	6	24
Southampton	4	43	17
Springfield	6	28	40
Washington	2	7	10
Westampton	1	5	10
Willingboro	4	5	4
Woodland	2	1	2
	370	973	886

CAMDEN COUNTY.

	M.	B.	D.
*Camden City	2,663	875	1,019
Centre	6	48	33
Delaware	1	15	22
Gloucester City	48	63	99
Gloucester	19	69	66
Haddon	25	66	67
Stockton	22	65	64
Waterford	10	67	28
Winslow	10	41	16
	2,799	1,309	1,414

*2,157 non-resident marriages.

CAPE MAY COUNTY.

	M.	B.	D.
Cape May City	28	36	33
Dennis	14	42	26
Lower	12	32	28
Middle	17	47	37
Upper	11	40	26
	82	197	150

CUMBERLAND COUNTY.

	M.	B.	D.
Bridgeton	96	271	120
Commercial	16	71	21
Deerfield	11	19	18
Downe	20	29	16
Fairfield	6	38	12
Greenwich	6	20	13
Hopewell	9	82	12
Landis	71	169	110
Lawrence	20	88	27
Maurice River	16	39	40
Millville	97	291	139
Stoe Creek	5	22	7
	373	1,039	535

ESSEX COUNTY.

	M.	B.	D.
Belleville	16	78	49
Bloomfield	42	162	69
Caldwell	23	27	47
Clinton	20	47	32
East Orange	53	190	128
Franklin	10	10	23
Livingston	12	19	26
Milburn	15	85	21
Montclair	32	189	83
Newark	1,416	4,811	3,663
Orange	149	416	304
South Orange	24	61	39
West Orange	12	68	46
	1,824	5,563	4,580

GLOUCESTER COUNTY.

	M.	B.	D.
Clayton	21	62	37
Deptford	4	38	28
East Greenwich	10	20	30
Franklin	9	63	38
Glassboro	26	78	46
Greenwich	6	47	26
Harrison	7	29	30
Logan	10	39	21
Mantua	11	83	23
Monroe	11	27	38
South Harrison	11	12	5
Washington	7	22	29
West Deptford	2	31	22
Woodbury	45	83	67
Woolwich	22	59	31
	202	648	461

NUMBER OF MARRIAGES, BIRTHS AND DEATHS, BY TOWNSHIPS.

FOR THE YEAR ENDING JUNE 30, 1886.

ATLANTIC COUNTY.

	M.	B.	D.
Absecon	9	18	6
Atlantic City	99	205	167
Buena Vista	....	15	12
Egg Harbor City	29	41	29
Egg Harbor Township	26	81	56
Galloway	4	85	30
Hamilton	17	29	22
Hammonton	16	53	37
Mullica	4	12	7
Weymouth	8	11	6
	207	495	371

BERGEN COUNTY.

	M.	B.	D.
Englewood	30	54	72
Franklin	21	84	30
Harrington	9	43	25
Hohokus	19	55	38
Lodi	32	83	73
Midland	1	22	25
New Barbadoes	40	101	96
*Orvil	....	4	....
Palisade	22	42	24
Ridgefield	19	77	53
Ridgewood	11	26	18
Saddle River	7	28	24
Union	12	71	62
Washington	10	62	45
	233	702	587

* New Township.

BURLINGTON COUNTY.

	M.	B.	D.
Bass River	8	17	12
Beverly	22	19	58
Bordentown	29	100	98
Burlington	83	140	165
Chester	28	56	85
Chesterfield	14	28	14
Cinnaminson	18	64	18
Delran	11	28	10
Eastampton	....	19	5
Evesham	9	27	16
Florence	6	41	22
Little Egg Harbor	11	51	30
Lumberton	1	18	3
Mansfield	10	87	25
Medford	11	89	37
Mt. Laurel	2	18	12
New Hanover	18	57	36
Northampton	60	86	94
Pemberton	18	42	40
Randolph	1	6	4
Shamong	1	6	24
Southampton	4	43	17
Springfield	6	28	40
Washington	2	7	10
Westampton	1	5	10
Willingboro	4	5	4
Woodland	2	1	2
	370	978	896

CAMDEN COUNTY.

	M.	B.	D.
*Camden City	2,663	875	1,019
Centre	6	48	33
Delaware	1	15	22
Gloucester City	43	63	99
Gloucester	19	69	66
Haddon	25	66	67
Stockton	22	65	64
Waterford	10	67	28
Winslow	10	41	16
	2,799	1,309	1,414

*2,157 non-resident marriages.

CAPE MAY COUNTY.

	M.	B.	D.
Cape May City	28	86	33
Dennis	14	42	26
Lower	12	32	28
Middle	17	47	37
Upper	11	40	26
	82	197	150

CUMBERLAND COUNTY.

	M.	B.	D.
Bridgeton	96	271	120
Commercial	16	71	21
Deerfield	11	19	18
Downe	20	29	16
Fairfield	6	38	12
Greenwich	6	20	13
Hopewell	9	32	12
Landis	71	169	110
Lawrence	20	38	27
Maurice River	16	39	40
Millville	97	291	139
Stoe Creek	5	22	7
	373	1,039	535

ESSEX COUNTY.

	M.	B.	D.
Belleville	16	78	49
Bloomfield	42	162	69
Caldwell	23	27	47
Clinton	20	47	32
East Orange	58	190	128
Franklin	10	10	23
Livingston	12	19	26
Milburn	15	85	21
Montclair	32	139	83
Newark	1,416	4,311	3,663
Orange	149	416	304
South Orange	24	61	39
West Orange	12	68	46
	1,824	5,563	4,580

GLOUCESTER COUNTY.

	M.	B.	D.
Clayton	21	62	37
Deptford	4	38	28
East Greenwich	10	20	30
Franklin	9	63	38
Glassboro	26	78	46
Greenwich	6	47	26
Harrison	7	29	30
Logan	10	39	21
Mantua	11	33	23
Monroe	11	27	38
South Harrison	11	12	5
Washington	7	22	29
West Deptford	2	31	22
Woodbury	45	83	57
Woolwich	22	59	31
	202	648	461

HUDSON COUNTY.

	M.	B.	D.
Bayonne	81	276	311
Guttenberg	6	47	44
Harrison	19	207	177
Hoboken	458	989	925
Jersey City	952	2,155	3,380
Kearny	2	62	54
North Bergen	9	51	225
Town of Union	114	228	185
Union	12	46	34
Weehawken	....	32	45
West Hoboken	62	280	169
	1,715	4,328	5,549

HUNTERDON COUNTY.

	M.	B.	D.
Alexandria	9	27	14
Bethlehem	14	49	31
Clinton	22	61	41
Delaware	22	57	35
East Amwell	15	27	22
Franklin	12	22	22
Frenchtown	15	12	10
High Bridge	10	18	13
Holland	19	36	22
Kingwood	10	20	16
Lambertville	62	91	80
Lebanon	27	48	47
Raritan	37	54	53
Readington	31	53	49
Tewksbury	2	31	15
Union	4	18	8
West Amwell	8	15	8
	*314	629	486

* 34 non-resident marriages.

MERCER COUNTY.

	M.	B.	D.
Chambersburg	88	121	171
East Windsor	24	31	46
Ewing	5	11	74
Hamilton	29	38	42
Hopewell	28	60	54
Lawrence	4	20	22
Millham	10	34	38
Princeton	22	77	69
Trenton	478	488	520
Washington	6	25	13
West Windsor	11	11	22
	†700	916	1,071

† 71 non-resident marriages.

MIDDLESEX COUNTY.

	M.	B.	D.
Cranbury	19	84	29
East Brunswick	34	66	44
Madison	3	19	7
Monroe	18	38	35
New Brunswick	168	382	348
North Brunswick	7	28	11
Perth Amboy	45	206	121
Piscataway	18	60	58
Raritan	20	56	78
Sayreville	6	14	26
South Amboy	28	101	84
South Brunswick	13	34	35
Woodbridge	19	82	85
	893	1,114	961

MONMOUTH COUNTY.

	M.	B.	D.
Atlantic	7	28	16
Eatontown	20	85	39
Freehold	51	85	82
Holmdel	7	29	15
Howell	30	68	28
Long Branch	60	101	66
Manalapan	21	28	30
Marlboro	5	19	39
Matawan	23	64	40
Middletown	31	98	77
Millstone	8	20	38
Neptune	63	182	121
Ocean	16	46	35
Raritan	30	104	78
Shrewsbury	54	148	134
Upper Freehold	23	70	44
Wall	35	115	66
	484	1,180	903

MORRIS COUNTY.

	M.	B.	D.
Boonton	22	32	32
Chatham	39	69	67
Chester	13	51	26
Hanover	15	45	117
Jefferson	8	9	14
Mendham	13	20	15
Montville	6	8	17
Morristown	54	164	120
Mount Olive	14	22	24
Passaic	6	17	15
Pequannock	21	49	21
Randolph	46	112	112
Rockaway	31	59	72
Roxbury	12	65	36
Washington	12	56	22
	312	847	737

OCEAN COUNTY.

	M.	B.	D.
Berkeley	1	18	11
Brick	33	75	57
Dover	23	44	32
Eaglewood	4	12	15
Jackson	19	32	16
Lacey	9	11	9
Manchester	10	25	16
Ocean	4	10	3
Plumsted	10	33	29
Stafford	5	25	8
Union	8	25	24
	126	310	220

PASSAIC COUNTY.

	M.	B.	D.
Acquackanonk	6	81	26
Little Falls	14	32	27
Manchester	1	12	23
Passaic	53	246	175
Paterson	563	1,534	1,100
Pompton	26	87	20
Wayne	4	25	7
West Milford	18	45	31
	685	1,962	1,409

SALEM COUNTY.

	M.	B.	D.
Alloway	16	25	25
Elsinboro	....	8	4
Lower Alloways Creek	2	6	11
Lower Penns Neck	5	20	21
Mannington	4	24	33
Oldmans	9	30	18
Pilesgrove	17	58	57
Pittsgrove	17	64	27
Quinton	12	39	19
Salem	55	115	123
Upper Penns Neck	23	27	33
Upper Pittsgrove	7	23	13
	167	434	389

SOMERSET COUNTY.

	M.	B.	D.
Bedminster	12	32	23
Bernards	16	35	25
Branchburg	4	15	11
Bridgewater	73	137	129
Franklin	18	71	47
Hillsborough	15	47	34
Montgomery	15	39	20
North Plainfield	28	72	39
Warren	5	20	14
	181	468	342

SUSSEX COUNTY.

	M.	B.	D.
Andover	7	16	18
Byram	15	30	17
Frankford	19	20	26
Green	16	14	7
Hampton	4	4	10
Hardyston	23	14	22
Lafayette	8	10	5
Montague	3	7	14
Newton	29	15	35
Sandyston	11	14	16
Sparta	19	10	12
Stillwater	4	18	16
Vernon	5	26	19
Walpack	8	10	9
Wantage	26	48	52
	197	251	278

UNION COUNTY.

	M.	B.	D.
Clark	....	....	....
Cranford	8	17	8
Elizabeth	240	882	607
Fanwood	3	26	11
Linden	7	27	31
New Providence	2	15	15
Plainfield	61	122	153
Rahway	44	103	100
Springfield	5	16	12
Summit	27	35	24
Union	9	22	34
Westfield	13	53	35
	422	1,318	1,080

WARREN COUNTY.

	M.	B.	D.
Allamuchy	....	6	8
Belvidere	38	31	37
Blairstown	6	25	16
Franklin	5	23	15
Frelinghuysen	15	24	16
Greenwich	10	19	12
Hackettstown	23	56	34
Hardwick	4	11	3
Harmony	11	33	14
Hope	6	34	29
Independence	10	10	7
Knowlton	41	23	24
Lopatcong	2	51	19
Mansfield	8	17	19
Oxford	32	124	51
Pahaquarry	....	4	6
Phillipsburg	301	219	116
Pohatcong	10	33	20
Washington	43	81	44
	*565	824	490

*265 non-resident marriages.

TOTALS OF MARRIAGES, BIRTHS AND DEATHS FOR ALL THE COUNTIES.

	M.	B.	D.
Atlantic	207	495	871
Bergen	233	702	587
Burlington	370	973	836
Camden	2,799	1,309	1,414
Cape May	82	197	150
Cumberland	373	1,039	535
Essex	1,824	5,563	4,530
Gloucester	202	648	461
Hudson	1,715	4,323	5,549
Hunterdon	314	629	486
Mercer	700	916	1,071
Middlesex	393	1,114	951
Monmouth	484	1,180	903
Morris	312	847	787
Ocean	126	310	220
Passaic	685	1,962	1,409
Salem	167	434	389
Somerset	181	468	342
Sussex	197	251	278
Union	422	1,318	1,030
Warren	565	824	490
	†12,351	25,497	22,784

†2,527 non-resident marriages.

RETURNS OF DEATHS FROM ALL CAUSES.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886—By Counties.

COUNTIES. Statistical Divisions. *	DEATHS AT ALL AGES.											PRINCIPAL CAUSES OF DEATH																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	Death-rate per 1,000, without cities of over 5,000.	Deaths under five in each 100, or comparison of these with total deaths.	Comparative number of deaths in each 100 from chief preventable diseases.	Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Atlantic	93	48	32	105	92	371	22,356	16.60	14.15	38.01	26.68	2	10	...	2	1	4	19	1	56	19	25	28	28	26	18	30	29	7	2	7	13
Bergen	134	45	45	178	180	567	39,880	14.72	14.72	30.49	20.10	11	15	...	3	2	6	9	...	73	33	43	54	43	54	38	56	44	15	1	7	29
Burlington	171	89	66	222	280	836	57,558	14.52	13.13	31.10	23.44	5	28	...	7	1	11	28	4	112	41	58	66	40	72	30	93	77	23	2	9	29
Camden	367	203	150	446	234	1414	76,685	18.44	16.60	40.31	28.78	7	50	...	16	2	5	113	2	212	95	109	107	109	69	48	111	72	29	3	23	62
Cape May	39	14	8	32	56	150	10,744	13.96	13.96	35.33	19.33	2	3	...	......	...	4	......	1	19	8	3	15	10	14	6	20	13	5	..	1	7
Cumberland	127	54	36	177	138	535	41,952	12.74	11.95	33.83	20.93	3	21	...	2	1	3	14	2	66	36	60	38	41	37	24	55	21	17	1	6	18
Essex	1080	656	403	1511	874	4530	213,764	21.19	12.36	38.32	22.41	48	101	1	29	16	63	291	23	443	367	285	516	402	343	194	364	225	115	8	44	140
Gloucester	102	56	48	132	114	461	27,603	16.70	16.70	34.27	19.96	4	14	...	......	...	6	13	1	54	31	37	39	46	16	13	54	26	11	5	8	19
Hudson	1464	1053	533	1788	698	5549	240,342	23.09	27.42	45.36	28.82	56	130	2	97	47	75	471	15	707	391	314	700	511	257	195	206	244	106	16	44	280
Hunterdon	85	41	32	139	188	486	37,420	12.99	12.99	25.93	14.20	6	7	...	8	2	7	18	3	23	32	41	43	31	56	26	72	27	20	1	9	15
Mercer	212	131	116	334	251	1071	66,785	16.04	15.93	32.59	22.04	11	20	...	13	1	4	78	6	103	103	69	82	69	71	48	123	40	21	2	10	57
Middlesex	222	107	108	291	210	951	56,180	16.93	15.25	34.60	25.55	5	19	...	9	3	15	41	1	150	63	33	73	65	55	41	69	65	25	9	12	63
Monmouth	210	87	90	271	235	903	62,324	14.49	14.64	32.89	23.70	16	15	1	5	1	15	28	3	130	65	69	69	40	79	45	75	54	20	1	9	41
Morris	130	69	55	238	237	737	50,675	14.54	14.72	27.06	18.05	13	18	...	9	1	4	21	2	65	47	52	66	44	53	33	138	39	19	3	9	29
Ocean	36	20	15	78	69	220	15,586	14.13	14.12	25.45	14.09	1	16	...	......	1	1	2	...	20	26	29	11	17	17	11	15	14	6	...	3	15
Passaic	379	178	110	481	262	1409	83,374	16.90	11.38	39.53	20.65	18	26	...	5	4	7	48	5	181	111	113	131	120	97	53	94	74	38	5	24	80
Salem	92	59	41	80	109	389	25,373	15.33	13.40	38.82	30.33	4	19	...	11	...	5	38	2	49	19	25	27	24	15	16	41	22	7	...	3	9
Somerset	63	20	57	95	127	342	27,425	12.47	12.47	24.26	19.58	6	5	...	1	...	9	14	1	52	26	24	22	12	38	14	36	21	20	3	4	12
Sussex	35	13	28	75	114	273	22,401	12.19	12.19	17.58	13.92	4	10	...	2	...	3	7	...	12	13	23	43	8	25	12	31	18	12	2	3	18
Union	282	123	81	298	240	1030	61,839	16.66	12.19	39.32	23.11	22	21	...	13	3	20	40	4	115	76	59	114	82	76	32	81	57	19	...	17	49
Warren	85	57	39	138	170	490	37,737	12.98	12.60	28.96	16.33	3	7	...	6	2	7	10	3	42	29	33	56	32	36	29	68	31	8	4	5	22
Totals	*5414	¶3123	2073	7109	4868	22,734	1,278,033	17.80	14.34	37.55	23.85	243	545	4	222	88	274	1303	79	†2664	1651	1554	2300	1774	1506	‖926	1932	‡1213	548	68	§257	997

* Of those dying under 1 year, 1,591 died under 1 month, of which 1,094 died in the larger cities. Of those dying under 1 year, 3,760 died in the larger cities.

† Of these 109 died of dysentery. ‡ Of these 111 died of dysentery. § Of these 41 were not connected with birth.

‖ Of these 84 died of cystitis, etc. ¶ Of the 8,537 that died under 5 years, 6,022 died in the larger cities.

Total deaths from consumption for the State, as compared with total deaths, 14.10—being 2,051 in cities and 1,154 outside.

Rates for short periods, or which deal with small numbers, are only approximate, since temporary causes may have been in operation, and small numbers do not eliminate or balance errors which practically disappear in large aggregates. The number of deaths before 20, in proportion to the rest, are much more informatory as to local causes affecting health, than the total deaths. So, also, the number dying from the zymotic diseases.

Return of Deaths from all Causes and Certain Specified Diseases, in the Cities of the State of New Jersey, of over 5,000 Population, for the Year ending June 30th, 1886.

CITIES HAVING OVER 5,000 POPULATION. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	Deaths under five in each 100, or comparison of these with total deaths.	Comparative number of deaths in each 100 from chief preventable diseases.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Atlantic County.																															
Atlantic City	50	21	15	54	27	167	7,912	21.03	42.52	23.35	......	4	...	......	...	2	4	1	28	8	6	14	17	14	9	17	11	2	1	2	4
Burlington County.																															
Bordentown	15	10	10	25	33	93	5,857	15.88	26.88	22.58	2	3	...	......	...	2	1	...	13	9	10	5	5	6	4	13	8	4	......	2	8
Burlington	36	22	15	40	51	165	7,690	21.46	35.15	27.27	3	3	...	5	...	4	11	...	19	4	11	11	10	10	8	18	11	5	......	2	8
Camden County.																															
Camden City	265	147	110	330	159	1019	52,884	19.27	40.43	29.24	6	41	...	12	1	3	87	2	146	72	76	75	82	40	34	79	45	26	3	16	52
Gloucester City	29	11	7	39	13	99	5,966	16.59	40.40	25.25	......	1	...	......	1	2	5	...	16	7	10	5	5	4	6	7	4	......	......	1	5
Cumberland County.																															
Bridgeton	31	9	7	41	31	120	10,063	11.92	33.33	20.83	......	3	...	......	1	......	6	1	14	4	16	9	9	10	8	11	5	4	......	...	2
Millville	35	21	11	49	23	139	8,824	15.75	40.29	25.78	3	10	...	2	...	......	1	1	23	13	19	10	11	8	3	9	2	7	......	3	4
Essex County.																															
Newark	897	551	333	1250	629	3663	152,988	23 94	39.53	23.07	33	85	1	22	14	44	257	20	569	202	244	415	341	251	144	294	180	91	4	34	119
Orange	72	61	26	94	59	304	15,231	19.96	40.46	21.38	1	7	...	3	...	8	15	1	30	34	18	39	25	24	20	13	19	5	......	3	6
Hudson County.																															
Bayonne	104	76	32	75	24	311	13,080	23.78	57.88	29.90	5	6	...	7	2	2	35	...	36	13	16	32	35	10	6	8	8	5	1	...	30
Harrison	31	34	33	58	18	177	6 806	26.01	38.42	32.20	4	9	...	......	1	3	24	...	17	15	11	18	18	8	2	14	6	2	......	4	6
Hoboken	260	194	64	296	110	925	37,721	24.52	49.08	31.46	4	20	...	2	14	17	85	3	146	67	54	91	94	54	37	50	32	17	3	7	36
Jersey City	897	592	329	1130	423	3380	153,513	22 02	44.08	27.60	25	88	...	76	24	44	258	11	407	235	192	454	309	147	126	184	169	67	11	25	153
Town of Union	55	31	17	52	27	185	8,398	22.03	48.11	23.51	3	3	...	3	2	3	17	...	31	15	10	25	19	15	2	10	7	3	......	2	4
Mercer County.																															
Chambersburg	46	31	19	48	24	171	8,542	20.09	45.03	30.41	......	3	...	5	...	1	17	...	28	21	11	14	9	8	7	9	2	3	......	...	14
Trenton	112	72	51	166	107	520	34,386	15 12	35.38	21.15	8	12	...	3	...	1	37	3	46	55	32	48	41	36	23	45	23	9	1	7	20
Middlesex County.																															
New Brunswick	83	37	39	100	84	348	18,256	19.06	34.48	26.15	1	3	...	1	1	11	16	...	58	24	32	33	28	23	15	23	20	15	3	2	15
Perth Amboy	41	15	17	34	14	121	6,311	19.17	46.28	22.31	1	3	...	3	1	......	3	...	16	14	8	9	16	2	5	8	6	......	......	2	9
Monmouth County.																															
Long Branch	25	7	4	17	13	66	5,140	12.84	48.48	33 33	1	......	...	......	...	1	3	...	17	5	3	2	4	3	5	......	3	3	......	...	5
Morris County.																															
Morristown	16	11	9	46	38	120	8,760	13.70	22 50	25.00	......	5	...	1	...	......	6	1	17	10	12	5	5	9	6	14	9	6	3	2	2
Passaic County.																															
Passaic City	59	34	13	46	22	175	8,326	21.02	53.14	24.57	1	1	...	2	2	......	5	...	32	10	12	15	25	7	8	13	7	3	2	1	7
Paterson	288	131	89	391	193	1100	63,273	17.38	38.09	19.91	13	21	...	2	2	6	37	5	133	92	90	98	89	78	42	70	60	31	3	21	63
Salem County.																															
Salem City	28	29	18	20	28	123	5,516	22.30	46.34	30.84	1	3	...	......	...	3	25	1	16	7	7	8	8	3	4	5	7	4	......	......	1
Union County.																															
Elizabeth	202	76	44	169	114	607	32,119	18.90	45.80	23.23	13	9	...	8	3	13	12	3	80	37	33	76	62	42	18	46	21	9	......	5	29
Plainfield	33	14	15	42	48	153	8,913	17.17	30.07	24.84	3	7	...	2	...	4	4	...	18	15	11	18	5	12	2	12	11	1	......	5	5
Rahway	18	13	9	35	25	100	6,861	14.58	31.00	21.00	1	1	...	1	...	......	11	...	7	8	4	10	8	7	5	10	10	4	......	3	4
Warren County.																															
Phillipsburg	30	19	10	35	22	116	8,058	14.40	43.24	19.83	......	1	...	5	...	......	3	...	14	4	10	20	7	7	4	9	7	1	2	...	7
Totals	3780	2363	1346	4682	2354	14,467	701,428	20.63	41.63	25.66	132	352	1	165	69	173	985	53	1775	1101	950	1554	1287	838	553	991	693	327	37	146	625

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

ATLANTIC COUNTY. POPULATION, 22,356. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Absecon	1	1			3	5	567										1				1	1		1		1			
*Atlantic City	50	21	15	51	27	167	7,942	21.03		4				2	4	1	26	8	8	14	17	14	9	17	11	2	1	2	4
Beuna Vista	4		1	3	4	12	1,016										3		1		1	2		1		1			1
Egg Harbor City	6	1	4	11	7	29	1,317			1							2	5	4		3	1	1	2	5				2
Egg Harbor Township	18	10	4	12	12	56	3,919						1		8		11	1	5	5	2	5	3	4	4			2	1
Galloway	5	1	2	10	12	30	2,153		2	1				1	3		4	3	2	2		1	1	2	1	2	1		2
Hamilton	3	5	3	6	5	22	1,484							1			3	1	2	4	1	1	1	1	2			2	1
Hammonton	6	6	2	8	15	37	2,525			2		2			4		3	1	3	2	2		2	1	4	1		1	2
Mullica		2			5	7	807										1			1	1		1	1	1				
Weymouth		1	1	1	2	6	626			2							1					1			1				
Totals	93	48	32	105	92	371	22,356	16.60	2	10		2	1	4	19	1	56	19	25	28	28	26	18	30	29	7	2	7	13

*This and all other cities that are health resorts have an excessive death-rate by reason of temporary increase of population, which also includes a proportion of invalids above the average. Local Boards show this on their records.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

BERGEN COUNTY.
POPULATION, 39,880.

Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.
Englewood	18	5	6	28	15	72	4,429	......
Franklin	5	3	......	11	11	30	2,194	......
Harrington	5	1	6	6	7	25	2,604	......
Hohokus	4	1	4	15	13	38	2,898	......
Lodi	24	12	2	18	17	73	4,347	......
Midland	6	2	3	4	10	25	1,617	......
New Barbadoes	21	7	7	30	31	96	4,983	......
*Orville	......	......	......	......	......	......	......	......
Palisade	7	1	2	5	9	24	2,333	......
Ridgefield	5	3	5	26	14	53	4,487	......
Ridgewood	4	1	1	7	5	18	1,776	......
Saddle River	5	1	1	5	12	24	1,564	......
Union	22	6	6	14	14	62	3,914	......
Washington	8	2	3	9	22	45	2,714	......
Totals	134	45	45	178	180	587	39,880	14.72

Statistical Divisions.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Englewood	......	2	......	......	......	......	......	......	12	3	8	10	6	8	5	3	8	1	......	......	2
Franklin	1	......	......	......	......	......	1	......	......	2	2	2	4	3	6	6	......	1	......	......	1
Harrington	1	2	......	......	......	......	1	......	2	2	1	3	1	3	1	2	2	1	......	......	......
Hohokus	......	3	......	......	......	......	......	......	6	3	2	2	......	3	4	3	4	5	......	1	1
Lodi	3	1	......	......	......	1	3	......	14	5	6	6	8	4	2	3	3	......	......	1	5
Midland	1	1	......	......	......	......	2	......	3	......	1	1	3	1	2	5	1	1	......	1	......
New Barbadoes	1	3	......	......	2	......	......	......	15	6	8	11	6	10	3	10	5	3	......	2	5
*Orville	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Palisade	2	......	......	......	......	......	......	......	3	......	1	5	1	5	......	2	2	1	......	......	......
Ridgefield	......	1	......	......	......	......	1	......	3	2	4	8	4	3	3	8	3	1	......	......	8
Ridgewood	1	......	......	......	......	......	......	......	......	1	3	......	2	......	2	1	2	1	......	......	......
Saddle River	1	......	......	1	......	......	......	......	1	......	1	3	1	2	2	3	4	1	......	......	1
Union	......	1	......	1	......	4	1	......	9	6	2	1	7	2	4	8	5	1	1	......	6
Washington	......	1	......	......	......	1	......	......	6	3	4	1	......	10	3	5	5	......	......	2	......
Totals	11	15	......	2	2	6	9	......	73	33	43	54	43	54	38	56	44	15	1	7	29

*A new township, and so counted this year with the adjacent one.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

BURLINGTON COUNTY. Population, 57,558. Statistical Divisions.	DEATHS AT ALL AGES.								PRINCIPAL CAUSES OF DEATH.																					
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bass River	1	4	2	1	4	12	905								2		1		1	1	2		1	1	2				
Beverly	11	4	6	17	20	58	3,356			2		1			4	2	3	5	2	5	3	5	1	5	5	1			2
Bordentown	15	10	10	25	33	93	5,857	15.88	2	3				2	1		13	9	10	5	5	6	4	13	8	4		2	2
Burlington	36	22	15	40	51	165	7,690	21.46	3	3		5		4	11		19	4	11	11	10	10	8	18	11	5		2	8
Chester	10	3	1	10	11	35	3,071			1					2		7	2	1		3	3	2	3	3	3			
Chesterfield	3	2		3	6	14	1,453										1	1	1	3		1		3	2	1			
Cinnaminson	7	3	1	1	6	18	2,640										5	1		3	2	2		1		1			2
Delran	3	1	2	3	1	10	1,932								1		1			2		2		1				1	1
Easthampton				3	2	5	655											1	1			1						1	
Evesham	3		2	2	9	16	1,556			2									1	1		2		2	5				
Florence	12	2		4	3	22	1,562						1				7			1	1	3		1	2				2
Little Egg Harbor	9	4	2	7	8	30	1,885								2		4		3	1	3	1	1	5	4				1
Lumberton		1	1	1		3	1,735												1	1	1								
Mansfield	4		2	5	14	25	1,715			2							1			1	1	2	1	5	8	1	1		
Medford	8	1	2	13	12	37	2,064			2				1		1	4	2	1	3	1	2	2	7	5	1			1
Mt. Laurel	3	2	1	3	5	12	1,781			1					1		3		2			1	1		2				
New Hanover	3	5	2	12	13	36	2,235			1				1			3	4	3	3		6	1	6	3	1		1	2
Northampton	9	10	7	31	35	94	5,006			2		1		1	2		14	10	10	8		10	4	10	7	2	1	2	1
Pemberton	10	2	3	10	15	40	2,914			4				1		1	7		1	5	1	5	1	5	5	2			1
Randolph	2		1		1	4	365			1							1					2							
Shamong	3	4	3	3	10	24	933										6	1		3	2	3		2	3	1			
Southampton	3	4		7	3	17	2,263			1							4		3	1	1	1		1	1				1
Springfield	11	2		13	14	40	1,654			1				1	1		5	1	2	6	3	4	1	3	1	3			2
Washington	1	3		3	5	10	333			1									2		1		1			1			
Westampton	2		3	4	1	10	688			1					1		1		2	2			1						1
Willingboro	2				1	4	725										2												1
Woodland				1	1	2	805																	1		1			
Totals	171	89	66	222	[illegible]	536	57,556	14.52	5	28		7	1	11	28	4	112	41	58	66	40	73	30	93	77	28	2	9	29

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

CAMDEN COUNTY. POPULATION, 76,685. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																					
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Camden City	265	147	110	330	159	1,019	52,884	19.27	6	41	......	12	1	3	87	2	146	72	78	75	82	40	34	79	45	26	3	16	52
Centre	10	4	6	8	4	33	1,723	......	......	1	......	1	......	......	1	......	9	4	2	2	3	1	2	1	2	......	......	1	......
Delaware	3	5	3	7	4	22	1,572	......	......	1	......	1	......	......	3	......	3	......	1	1	1	3	1	3	3	......	......	......	......
Gloucester City	29	11	7	39	13	99	5,966	16.59	......	1	......	......	1	2	5	......	16	7	10	5	5	4	6	7	4	......	......	1	5
Gloucester	14	5	2	21	19	66	2,542	......	1	1	......	......	......	......	......	......	9	3	5	5	5	8	3	9	8	1	......	2	......
Haddon	17	12	11	15	12	67	3,270	......	......	1	......	......	......	......	13	......	13	3	4	11	4	1	......	3	4	1	......	2	1
Stockton	20	13	5	15	11	64	4,450	......	......	1	......	1	......	......	3	......	13	2	9	5	6	7	1	5	4	......	......	......	1
Waterford	4	5	4	9	5	26	2,098	......	......	3	......	1	......	......	1	......	2	4	2	......	2	4	1	2	1	......	......	......	2
Winslow	5	1	2	2	6	16	2,180	......	......	......	......	......	......	......	......	......	1	......	......	3	1	1	......	2	1	1	......	1	1
Totals	367	203	150	446	234	1,414	76,685	18.44	7	50	......	16	2	5	113	2	212	95	109	107	109	69	48	111	72	29	3	23	62

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

CAPE MAY COUNTY. Population, 10,744. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Cape May City	9	4	2	7	11	33	1,610	......	......	......	......	......	......	1	......	......	5	1	1	......	5	4	3	8	2	......	......	......	......
Dennis	8	1	2	6	8	26	2,328	......	......	1	......	......	......	......	......	......	2	......	......	5	3	1	......	2	4	2	......	......	2
Lower	10	3	1	5	9	28	2,026	......	1	......	......	......	......	......	......	1	5	1	......	3	1	3	1	2	3	1	......	......	......
Middle	5	1	3	7	21	37	2,606	......	......	1	......	......	......	2	......	......	3	3	1	5	......	4	1	5	4	1	......	......	3
Upper	7	5	......	7	7	26	2,175	......	1	1	......	......	......	1	......	......	4	3	1	2	1	2	1	3	......	1	......	1	2
Totals	39	14	8	32	56	150	10,744	13.96	2	3	......	......	......	4	......	1	19	8	3	15	10	14	6	20	13	5	......	1	7

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

CUMBERLAND COUNTY. POPULATION, 41,982. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bridgeton	31	9	7	41	31	120	10,065	11.92	......	3	......	......	1	......	6	1	14	4	16	9	9	10	8	11	5	4	......	......	2
Commercial	4	1	3	8	5	21	2,544	......	......	......	......	......	......	......	......	......	1	2	4	......	2	1	......	5	1	1	......	1	1
Deerfield	4	1	1	7	5	18	1,632	......	......	......	......	......	......	......	......	......	......	......	2	2	1	2	......	2	1	1	......	......	......
Downe	......	3	1	5	6	16	1,860	......	......	1	......	......	......	......	2	......	1	1	2	3	......	1	1	1	......	1	......	......	1
Fairfield	4	1	1	2	4	12	1,612	......	......	......	......	......	......	......	......	......	2	......	1	2	......	1	......	1	1	......	......	......	2
Greenwich	4	......	2	1	6	13	1,267	......	......	......	......	......	......	......	......	......	3	......	......	......	......	......	......	3	......	......	......	......	3
Hopewell	2	3	1	3	3	12	1,794	......	......	......	......	......	......	......	2	......	2	2	......	......	1	......	4	......	......	......	......	......	1
Landis	28	6	6	40	30	110	7,021	......	......	5	......	......	......	......	2	......	11	7	13	7	12	10	6	15	4	1	......	1	1
Lawrence	5	3	......	8	10	27	1,728	......	......	1	......	......	......	......	......	......	3	4	1	2	1	3	1	1	2	1	......	......	2
Maurice River	9	5	3	11	12	40	2,563	......	......	1	......	......	......	3	1	......	6	2	2	3	3	1	1	5	3	1	1	1	1
Millville	35	21	11	49	23	139	8,824	15.75	3	10	......	2	......	......	1	1	23	13	19	10	11	8	3	9	2	7	......	3	4
Stoe Creek	1	1	......	2	3	7	1,073	......	......	......	......	......	......	......	......	......	......	1	......	......	1	......	......	2	2	......	......	......	......
Totals	127	54	36	177	138	535	41,982	12.74	3	21	......	2	1	3	14	2	66	36	60	38	41	37	24	55	21	17	1	6	18

Return of Deaths from all Causes and certain specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

ESSEX COUNTY. POPULATION, 213,764. Statistical Divisions.	DEATHS AT ALL AGES.								PRINCIPAL CAUSES OF DEATH.																					
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Belleville	8	6	5	11	19	49	3,285	......	3	......	......	......	......	......	......	1	3	3	......	3	4	8	4	5	2	......	1	......	2
Bloomfield	10	7	4	20	28	69	6,502	......	......	......	......	......	......	......	1	1	7	11	3	13	3	8	3	7	4	3	......	1	1
Caldwell	6	2	5	12	22	47	3,336	......	2	1	......	......	......	......	2	......	3	1	2	2	3	13	1	7	4	2	......	......	3
Clinton	7	5	2	8	10	32	2,830	......	4	......	......	......	......	1	2	......	2	......	1	2	4	5	3	3	......	......	......	1	2
East Orange	33	9	12	37	37	128	10,328	......	1	4	......	1	1	2	8	......	13	11	5	18	7	9	7	14	5	4	2	......	......
Franklin	8	2	1	5	7	23	1,602	......	......	1	......	......	......	......	1	......	1	1	1	4	4	1	......	2	2	......	......	......	1
Livingston	5	4	2	4	10	26	1,275	......	......	......	......	1	......	1	3	......	......	2	......	3	2	4	3	2	1	......	......	1	......
Millburn	4	5	1	5	6	21	2,023	......	1	......	......	1	......	2	......	......	......	1	1	6	3	2	......	2	......	1	......	......	......
Montclair	18	3	8	29	25	83	6,327	......	2	1	......	......	......	3	1	......	8	12	5	6	4	9	4	5	4	6	......	1	1
Newark	897	551	233	1290	629	3663	152,988	23.94	33	85	1	22	14	44	257	20	369	302	244	415	341	251	144	294	180	91	4	34	119
Orange	72	51	26	94	59	304	15,231	19.96	1	7	......	3	......	8	15	1	30	34	16	39	25	24	20	13	19	5	......	3	6
South Orange	6	6	1	13	14	39	4,228	......	......	1	......	......	1	2	3	......	3	4	1	1	......	5	4	4	1	3	......	......	6
West Orange	6	6	3	23	8	46	3,812	......	1	1	......	1	......	1	1	......	4	5	4	4	3	4	1	6	3	......	1	3	1
Totals	1080	656	403	1511	874	4530	213,764	21.19	48	101	1	29	16	63	291	23	443	357	286	516	403	343	194	364	225	115	8	44	140

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

GLOUCESTER COUNTY. POPULATION, 27,603. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Clayton	9	5	8	10	4	37	2,399	......	1	1	......	......	......	......	......	......	6	4	1	1	9	......	1	3	3	......	1	1	1
Deptford	8	2	2	7	9	28	1,744	......	......	......	......	......	......	2	......	......	2	......	3	2	1	......	2	4	4	......	......	......	2
East Greenwich	5	2	4	8	10	30	1,233	......	1	......	......	......	......	......	......	......	2	......	2	6	3	2	1	4	3	......	1	1	2
Franklin	4	5	5	15	9	38	2,362	......	1	......	......	......	......	......	2	......	2	1	4	4	2	......	......	5	1	2	......	1	3
Glassboro	10	4	7	18	7	46	2,377	......	......	1	......	......	......	......	1	......	5	4	5	2	7	2	......	2	5	2	1	......	......
Greenwich	6	3	5	6	6	26	1,729	......	......	3	......	......	......	......	2	1	1	1	2	......	4	1	......	3	1	......	......	......	3
Harrison	6	4	4	6	10	30	1,637	......	......	1	......	......	......	......	4	......	4	......	3	......	2	1	2	6	3	......	1	......	......
Logan	5	2	1	3	7	21	1,653	......	......	2	......	......	......	......	3	......	3	1	1	1	......	3	......	3	......	1	......	1	......
Mantua	4	5	1	5	8	23	1,624	......	......	......	......	......	......	......	......	......	5	......	3	3	2	2	......	3	1	2	......	1	......
Monroe	6	9	4	8	9	38	1,950	......	1	1	......	......	......	......	1	......	2	4	3	6	3	......	1	6	......	1	......	......	1
South Harrison	1	......	......	2	2	5	1,091	......	......	......	......	......	......	......	......	......	1	......	1	......	......	1	......	1	......	......	......	......	......
Washington	7	6	......	9	7	29	1,265	......	......	1	......	......	......	1	......	......	8	3	4	1	1	......	1	4	......	......	......	......	1
West Deptford	6	3	2	3	7	22	1,305	......	......	1	......	......	......	......	......	......	2	1	......	2	5	......	2	2	......	1	1	......	1
Woodbury	16	2	5	22	11	57	3,278	......	......	1	......	......	......	2	......	......	6	10	3	6	5	2	2	3	4	2	......	2	5
Woolwich	9	3	......	10	8	31	2,046	......	......	2	......	......	......	1	......	......	5	2	3	4	2	2	1	5	1	......	......	1	......
Totals	103	56	48	132	114	461	27,603	16.70	4	14	......	......	......	6	13	1	54	31	37	39	46	16	13	54	26	11	5	8	19

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

MERCER COUNTY. Population, 66,785. Statistical Divisions.	DEATHS AT ALL AGES.								PRINCIPAL CAUSES OF DEATH.																					
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Chambersburg	46	31	19	48	24	171	6,512	20.02	......	3	......	5	......	1	17	......	26	21	11	14	9	8	7	9	2	3	......	......	14
East Windsor	9	2	4	12	19	46	2,568	....	1	1	......	......	......	......	......	1	5	1	2	1	4	8	4	9	1	......	......	......	2
Ewing	5	3	5	37	23	74	2,489	....	1	3	......	......	......	......	3	1	2	5	5	2	1	2	1	32	5	1	......	1	3
Hamilton	9	2	3	15	13	42	3,420	....	......	......	......	1	1	2	......	......	4	4	2	5	......	3	......	5	......	2	......	1	5
Hopewell	7	3	5	9	29	54	4,367	....	1	......	......	1	......	......	1	1	3	1	6	2	6	4	3	10	3	2	......	......	1
Lawrence	4	......	4	9	5	22	1,589	....	......	1	......	......	......	......	3	......	2	2	1	1	1	1	......	2	1	1	......	......	4
Millham	12	11	3	8	4	38	2,338	....	......	......	......	1	......	......	5	......	7	2	1	3	2	......	2	......	......	......	1	1	4
Princeton	10	3	22	14	16	69	4,577	....	......	......	......	1	......	......	12	......	5	5	7	5	3	6	4	6	4	......	......	......	1
Trenton	112	72	51	166	107	520	34,386	15.12	8	12	......	3	......	1	37	3	46	58	32	48	41	36	23	45	23	9	1	7	20
Washington	2	1	......	9	1	13	1,196	....	......	......	......	1	......	......	......	......	1	1	1	......	1	2	1	2	1	1	......	......	......
West Windsor	2	3	......	7	10	22	1,313	....	......	......	......	......	......	......	......	......	2	3	1	1	1	1	5	5	......	2	......	......	2
Totals	216	131	116	334	251	1,071	66,785	16.04	11	20	......	15	1	4	78	6	103	103	69	82	69	71	48	123	40	21	2	10	57

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

MIDDLESEX COUNTY. Population, 56,180. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Cranbury	5	4	2	11	7	29	1,569	......	......	1	......	......	......	1	......	......	2	2	5	4	1	1	6	1	1	1	1	1	......
East Brunswick	7	4	7	13	11	44	3,697	......	......	2	......	......	......	......	......	......	2	2	4	7	4	8	......	2	3	1	......	1	4
Madison	3	......	......	2	2	7	1,519	......	1	......	......	......	......	......	1	......	1	2	......	1	......	......	......	......	1	......	......	......	......
Monroe	4	4	7	11	9	35	3,199	......	......	......	......	......	......	......	2	......	9	......	4	1	2	1	2	7	1	1	......	1	......
New Brunswick	83	37	39	100	84	348	18,258	19.06	1	3	......	1	1	11	16	......	58	24	32	28	25	23	15	23	20	15	3	2	15
North Brunswick	1	1	......	5	4	11	1,272	......	......	......	......	......	1	......	......	......	......	2	......	1	1	2	......	4	......	......	......	......	......
Perth Amboy	41	15	17	34	14	121	6,311	19.17	1	3	......	3	1	......	3	......	16	14	8	9	16	2	5	8	6	......	......	2	9
Piscataway	10	3	......	16	23	53	3,155	......	......	......	......	......	......	1	......	......	7	3	3	2	1	4	2	5	7	3	1	......	3
Raritan	13	9	4	29	18	73	3,656	......	......	......	......	2	......	......	3	1	13	3	7	3	4	2	4	5	11	1	1	......	4
Sayreville	9	3	6	8	......	26	2,549	......	......	2	......	......	......	......	4	......	4	......	......	2	1	1	......	......	1	......	2	......	4
South Amboy	23	14	9	27	10	84	4,051	......	1	6	......	1	......	......	8	......	18	5	8	5	4	6	2	5	5	1	......	1	5
South Brunswick	3	3	3	11	13	35	2,714	......	......	1	......	1	......	1	......	......	1	1	3	1	1	2	3	4	4	......	1	1	4
Woodbridge	21	10	14	24	15	85	4,227	......	1	1	......	1	......	1	4	......	19	5	9	9	2	3	2	5	5	2	......	3	5
Totals	222	107	108	291	210	951	56,180	16.93	5	19	......	9	3	15	41	1	150	63	83	73	65	55	41	69	60	25	9	13	53

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

MONMOUTH COUNTY. Population, 62,324. Statistical Divisions.	DEATHS AT ALL AGES.								PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Atlantic	3	2	1	5	5	16	1,656		1	......	......	......	......	......	1	......	2	2	4	......	1	1	......	2	1	......	......	......	......
Eatontown	9	4	6	8	12	39	2,812	....	1	1	......	1	......	1	......	......	7	1	3	2	2	5	1	3	3	......	......	1	3
Freehold	8	1	7	18	18	52	4,494	....	......	1	......	......	......	......	2	......	5	4	6	6	1	8	2	5	2	2	......	......	2
Holmdel	2	......	1	8	3	15	1,640	....	1	......	......	......	......	......	......	......	1	2	1	......	1	2	1	1	2	1	......	1	......
Howell	4	3	1	8	6	23	3,308	....	......	......	......	......	......	......	3	......	......	3	......	3	3	3	......	2	2	......	......	......	......
Long Branch	25	7	4	17	13	66	5,140	12.84	1	......	......	......	......	1	3	......	17	5	3	2	4	3	5	......	3	3	......	......	5
Manalapan	9	2	1	12	6	30	2,143	....	......	......	......	......	......	2	1	......	4	1	2	1	2	2	3	3	5	1	......	......	......
Marlboro	4	5	6	14	10	39	2,069	....	......	......	......	......	......	......	2	......	7	6	6	......	2	3	3	5	3	......	......	......	......
Matawan	10	1	9	8	11	40	2,756	....	......	......	......	......	......	......	4	......	4	1	4	6	1	3	......	4	3	......	......	1	4
Middletown	18	11	6	23	19	77	5,802	....	3	1	1	2	......	1	4	2	7	3	6	8	2	8	2	4	6	2	......	1	7
Millstone	4	1	4	14	10	33	1,917	....	......	......	......	1	......	......	......	......	3	3	5	1	1	2	4	2	1	......	......	......	4
Neptune	27	13	12	35	29	121	6,421	....	6	2	......	1	......	1	2	1	24	3	6	9	4	10	7	12	5	3	......	2	6
Ocean	11	3	......	9	12	35	2,400	....	......	......	......	......	......	......	1	......	7	2	2	2	1	3	1	6	1	1	......	1	......
Raritan	26	3	6	19	18	73	4,238	....	1	3	......	......	......	1	......	......	11	9	3	7	2	4	6	2	1	2	......	1	1
Shrewsbury	26	17	16	43	29	134	7,556	....	......	4	......	......	......	4	2	......	13	15	8	12	10	16	3	10	9	3	1	......	8
Upper Freehold	6	5	3	13	18	44	3,130	....	......	3	......	......	......	4	......	......	3	1	5	5	......	4	1	5	5	1	......	......	......
Wall	16	9	6	17	16	66	4,842	....	2	......	......	......	1	......	2	......	15	4	5	5	3	2	4	8	3	1	......	1	1
Totals	210	87	90	271	235	903	62,324	14.49	16	15	1	5	1	15	23	3	130	65	69	69	40	79	45	75	54	20	1	9	41

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

MORRIS COUNTY. Population, 50,675. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhœal diseases	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Boonton	3	3	1	8	17	32	2,732	......	2	1	......	......	......	1	......	......	2	2	3	2	1	5	3	1	2	1	......	......	4
Chatham	12	7	7	26	15	67	4,291	......	......	......	......	1	......	......	1	......	4	6	8	13	7	4	2	5	6	......	......	1	4
Chester	2	2	3	4	13	26	2,510	......	......	......	......	1	......	......	......	......	1	2	3	5	2	3	1	4	1	......	......	......	3
Hanover	6	2	6	52	49	117	4,459	......	2	1	......	......	......	......	1	......	4	3	4	1	2	8	7	71	3	3	......	......	1
Jefferson	3	1	......	4	6	14	1,359	......	1	......	......	......	......	......	......	......	2	2	1	1	1	1	......	2	2	......	......	......	......
Mendham	2	2	2	4	5	15	1,431	......	......	1	......	......	......	......	......	......	1	1	......	......	2	......	1	5	......	......	......	......	1
Montville	5	......	2	5	5	17	1,225	......	1	1	......	......	......	......	......	......	1	1	2	......	2	1	3	......	......	1	......	......	......
Morristown	16	11	9	46	38	120	8,760	13.70	......	5	......	1	......	......	6	1	17	10	12	5	5	9	6	14	9	6	2	2	2
Mt. Olive	3	2	1	10	8	24	2,005	......	2	......	......	......	......	......	......	......	1	1	2	1	2	1	1	6	2	......	......	1	1
Passaic	7	2	1	2	3	15	1,716	......	......	......	......	......	1	1	......	......	1	......	1	2	1	2	......	2	1	......	......	......	......
Pequannock	9	5	3	3	11	31	2,625	......	1	1	......	1	......	......	1	......	5	......	3	1	4	2	2	4	......	......	......	......	1
Randolph	30	12	8	35	26	112	7,045	......	1	2	......	2	......	......	5	......	17	10	3	17	3	6	......	13	5	4	......	4	6
Rockaway	16	9	8	22	16	73	5,573	......	2	3	......	2	......	......	......	......	3	3	5	10	8	6	3	4	6	2	......	1	5
Roxbury	11	6	1	10	7	36	2,184	......	......	1	......	1	......	1	5	1	3	5	3	3	2	......	1	2	2	......	......	......	2
Washington	5	5	3	7	16	38	2,560	......	1	2	......	......	......	1	2	......	3	1	2	5	2	5	3	5	......	2	......	......	......
Totals	130	69	55	238	237	737	50,675	14.54	13	18	......	9	1	4	21	2	65	47	52	66	44	53	33	138	39	19	3	9	29

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

SALEM COUNTY. Population, 25,373. Statistical Divisions	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever, etc.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhœal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Alloway	3	2	1	7	12	25	1,749	......	......	4	......	......	......	1	2	......	1	......	1	2	2	1	1	5	3	......	......	......	......
Elsinboro	2	......	......	...	2	4	571	......	......	......	......	......	......	......	......	......	......	......	......	1	......	......	......	1	......	......	......	......	......
Lower Alloways Creek	2	1	......	3	5	11	1,365	......	......	1	......	......	......	......	......	......	......	......	1	......	1	......	3	2	......	......	......	......	2
Lower Penns Neck	6	2	2	5	6	21	1,408	......	1	......	......	......	......	......	1	......	4	1	1	1	2	1	1	3	2	1	......	1	......
Mannington	7	6	4	10	9	38	2,161	......	......	3	......	......	......	1	......	......	1	2	3	1	3	2	1	6	3	1	......	......	2
Oldmans	6	2	2	3	5	18	1,463	......	......	......	......	......	......	......	3	......	2	......	1	......	......	1	1	2	......	......	......	......	1
Pilesgrove	11	6	6	13	21	57	3,397	......	1	5	......	......	......	......	2	......	9	6	7	5	1	2	2	6	1	......	......	......	2
Pittsgrove	8	2	3	5	8	27	2,135	......	......	......	......	1	......	......	1	......	4	......	1	......	2	2	2	3	1	1	......	......	1
Quinton	8	3	1	3	4	19	1,460	......	1	1	......	......	......	......	1	......	5	1	1	2	2	1	......	1	......	......	......	1	......
Salem	28	29	18	20	23	123	5,516	22.30	1	3	......	......	......	3	25	1	16	7	7	8	8	3	4	5	7	4	......	......	1
Upper Penns Neck	9	6	4	8	6	33	2,216	......	......	2	......	......	......	......	3	1	6	1	1	5	3	2	......	5	3	......	......	1	......
Upper Pittsgrove	2	......	......	3	8	13	1,932	......	......	......	......	......	......	......	......	......	1	1	1	2	......	......	1	2	2	......	......	......	......
Totals	92	59	41	80	109	389	25,373	15 33	4	19	......	1	......	5	38	2	49	19	25	27	24	15	16	41	22	7	......	3	9

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

SOMERSET COUNTY. Population, 27,425. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bedminster	5	1	4	2	11	23	1,769	......	1	......	......	1	......	1	......	......	2	1	......	5	......	2	1	3	1	1	......	......	1
Bernards	4	1	2	10	8	25	2,504	......	......	......	......	......	......	......	1	......	2	1	3	2	1	1	2	1	2	2	......	2	1
Branchburg	1	......	......	3	7	11	1,177	......	......	1	......	......	......	......	......	......	1	1	1	1	......	......	3	1	1	1	......	......	......
Bridgewater	21	8	15	35	50	129	8,454	......	4	1	......	......	......	4	4	1	13	11	8	6	7	16	1	15	11	6	2	......	4
Franklin	9	5	4	13	16	47	3,720	......	1	......	......	......	......	3	......	......	5	6	3	2	2	1	1	6	3	7	......	2	......
Hillsborough	5	1	4	11	13	34	3,151	......	......	2	......	......	......	......	5	......	......	4	2	3	......	8	2	2	......	1	......	......	3
Montgomery	4	......	2	5	9	20	1,800	......	......	......	......	......	......	1	......	......	1	......	1	......	......	4	2	3	1	......	1	......	2
North Plainfield	7	3	4	14	11	39	3,728	......	......	1	......	......	......	......	2	......	4	2	5	3	2	5	2	5	1	......	......	......	1
Warren	7	1	2	2	2	14	1,122	......	......	......	......	......	......	......	2	......	4	......	1	......	......	1	......	......	1	2	......	......	......
Totals	63	20	37	95	127	342	27,425	12.47	6	5	......	1	......	9	14	1	32	26	24	22	12	38	14	36	21	20	3	4	12

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

SUSSEX COUNTY. Population, 22,401. Statistical Divisions.	Deaths at all ages: Under one year.	One to five.	Five to twenty.	Twenty to sixty	Over sixty	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	Principal causes of death: Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Andover	1	......	1	4	7	13	1,014	......	......	1	......	......	......	......	......	......	......	......	1	2	1	......	1	3	1	1	......	......	......
Byram	4	......	3	4	6	17	1,212	......	1	......	......	......	......	......	1	......	1	1	2	2	......	2	2	1	......	1	......	......	1
Frankford	5	2	3	7	9	26	1,495	......	1	1	......	1	......	......	......	......	2	2	5	4	1	3	......	2	......	......	......	......	1
Green	1	1	2	2		7	704	......	......	1	......	......	......	......	......	......	2	......	......	1	1	1	......	......	......	......	......	1	......
Hampton	......	......	1	2		10	938	......	......	......	......	......	......	......	......	......	......	......	......	......	......	2	......	......	1	3	......	1	1
Hardyston	5	......	5	7	4	22	2,500	......	1	......	......	......	......	......	......	......	1	2	3	6	......	1	2	......	......	1	......	......	2
Lafayette	......	......	......	1	4	5	816	......	......	......	......	......	......	......	......	......	......	......	......	......	......	2	......	2	......	1	......	......	......
Montague	......	4		4	3	14	900	......	1	......	......	......	......	1	3	......	1	......	......	3	......	......	......	3	......	......	......	......	1
Newton	2	1		16	10	35	2,648	......	......	3	......	......	......	......	......	......	1	2	3	4	1	3	1	6	2	2	......	......	5
Sandyston	1	1	......	6	7	16	1,092	......	......	......	......	......	......	......	......	......	......	1	3	5	......	2	......	......	2	1	......	1	......
Sparta	2	......	2	4	4	12	1,901	......	......	1	......	......	......	......	2	......	1	2	1	1	......	......	......	2	1	......	......	......	......
Stillwater	2	......	1	1	12	16	1,366	......	......	......	......	......	......	......	......	......	1	......	1	2	1	2	3	2	1	......	......	......	2
Vernon	4	1	......	4	10	19	1,855	......	......	......	......	......	......	2	......	......	......	1	......	6	......	1	2	1	2	......	......	......	2
Walpack	......	1	4	2	2	9	553	......	......	1	......	1	......	......	......	......	......	......	......	1	2	......	......	2	1	......	1	......	......
Wantage	8	2	1	11	28	52	3,377	......	......	2	......	......	......	......	1	......	2	2	4	6	1	7	1	7	7	2	1	......	3
Totals	35	13	28	75	114	273	22,401	12.19	4	10	......	2	......	3	7	......	12	13	23	43	8	25	12	31	18	12	2	3	18

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

UNION COUNTY. POPULATION, 61,839. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Clark	......	......	......	......	......	......	363	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Cranford	......	......	3	1	4	8	1,251	......	1	1	......	......	......	......	1	......	......	1	......	......	......	1	......	......	2	......	......	......	......
Elizabeth	202	76	44	169	114	607	32,119	18.90	13	9	......	6	3	13	12	3	60	37	33	76	62	42	18	46	21	9	......	5	29
Fanwood	3	......	......	3	5	11	1,210	......	......	......	......	......	......	......	......	......	......	......	2	1	1	2	......	......	2	1	......	......	......
Linden	7	5	1	11	6	31	1,971	......	......	......	......	......	......	......	5	......	3	1	......	2	1	1	......	5	3	1	......	1	5
New Providence	2	2	......	6	5	15	824	......	......	1	......	......	......	1	1	......	1	3	1	1	......	3	......	2	1	......	......	......	......
Plainfield	32	14	15	42	48	153	8,913	17.17	3	7	......	2	......	4	4	......	18	15	11	18	5	12	2	12	11	1	......	5	5
Rahway	18	13	9	35	25	100	6,861	14.58	1	1	......	1	......	......	11	......	7	8	4	10	8	7	5	10	10	4	......	2	4
Springfield	1	2	2	3	4	12	847	......	1	......	......	......	......	......	1	......	......	1	2	......	2	......	1	......	......	......	......	2	1
Summit	3	3	1	12	5	24	2,539	......	......	......	......	......	......	2	2	1	1	4	2	2	1	1	3	1	3	......	......	1	......
Union	8	5	1	4	16	34	2,589	......	2	......	......	1	......	......	1	......	2	......	2	3	1	4	2	3	1	2	......	1	2
Westfield	6	3	5	12	8	35	2,352	......	1	2	......	1	......	......	2	......	3	6	2	1	1	3	1	2	3	1	......	......	3
Totals	282	123	81	298	240	1,030	61,839	16.66	22	21	......	13	3	20	40	4	115	76	59	114	82	76	32	81	57	19	......	17	49

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1886.

WARREN COUNTY. Population, 37,737. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, etc.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrheal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Allamuchy	3	.....	.....	3	2	8	787	....	1	.....	.....	.....	.....	.....	.....	.....	1	2	.....	1	.....	.....	.....	1	1	.....	.....	1	.....
Belvidere	2	2	1	13	19	37	1,814	....	.....	1	.....	.....	2	.....	.....	.....	3	1	2	3	.....	5	3	5	1	1	.....	.....	.....
Blairstown	2	2	.....	5	7	16	1,590	....	.....	.....	.....	.....	.....	.....	.....	1	1	.....	.....	2	2	3	.....	3	.....	4	.....	1	.....
Franklin	5	.....	1	3	5	15	1,382	....	.....	.....	.....	.....	.....	.....	.....	1	2	1	.....	.....	1	2	1	2	.....	.....	.....	1	.....
Frelinghuysen	1	5	1	3	6	16	964	....	.....	.....	.....	.....	.....	1	.....	.....	3	2	.....	.....	3	.....	.....	1	5	.....	.....	.....	1
Greenwich	2	1	2	2	5	12	920	....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	.....	1	.....	1	.....	3	.....	1	.....	1	1
Hackettstown	5	3	3	10	13	34	2,645	....	.....	.....	.....	.....	.....	.....	4	.....	2	.....	5	1	2	2	3	3	3	3	1	1	1
Hardwick	.....	.....	.....	1	2	3	520	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....
Harmony	2	2	1	4	5	14	1,256	....	.....	.....	.....	.....	.....	.....	.....	.....	2	2	2	1	2	.....	.....	2	1	.....	.....	.....	.....
Hope	5	3	1	7	13	29	1,548	....	.....	1	.....	.....	.....	.....	.....	.....	1	.....	.....	5	1	1	3	6	4	1	.....	.....	.....
Independence	.....	.....	.....	3	4	7	1,134	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	2	.....	.....	.....	2	1	.....	.....	.....	1
Knowlton	2	1	1	7	13	24	1,456	....	1	.....	.....	.....	.....	.....	.....	.....	2	1	.....	5	.....	1	5	6	2	.....	.....	.....	1
Lopatcong	3	2	3	4	7	19	1,725	....	.....	2	.....	.....	.....	.....	.....	.....	.....	1	2	1	3	.....	1	6	.....	.....	.....	.....	1
Mansfield	4	.....	1	4	10	19	1,600	....	.....	.....	.....	.....	.....	.....	.....	.....	3	2	1	1	.....	1	2	4	.....	.....	.....	.....	2
Oxford	8	10	7	13	13	51	4,382	....	.....	1	.....	.....	.....	5	2	.....	4	3	6	7	2	1	4	7	2	.....	.....	.....	3
Pahaquarry	.....	.....	.....	3	3	6	351	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	1	1	.....	.....	.....	.....	1
Phillipsburg	30	19	10	35	22	116	8,058	14.40	.....	1	.....	5	.....	.....	3	.....	14	4	10	20	7	7	4	9	7	1	2	.....	7
Pohatcong	2	2	2	6	8	20	1,567	....	1	1	.....	1	.....	.....	1	.....	2	1	1	1	1	5	1	1	3	.....	.....	.....	.....
Washington	9	5	5	12	13	44	4,038	....	.....	.....	.....	.....	.....	1	.....	1	1	4	4	3	6	4	3	5	1	.....	1	.....	3
Totals	85	57	29	138	170	490	37,737	12.98	3	7	.....	6	2	7	10	3	42	29	33	50	32	36	29	65	31	8	4	5	22

SYNOPSIS OF VITAL RETURNS AND COMMENTS ON SPECIAL DISEASES.

The records for the statistical year ending June 30th, 1886, as shown by the tables of this report, give an aggregate of 12,351 marriages, 25,497 births, and 22,734 deaths, of which numbers, as to marriage at least, 2,600 belong to adjacent States.

The following outline presents the comparative numbers for several years:

Average for five years ending June 30th, 1883:

Marriages	8,539
Births	24,281
Deaths	21,981

Number in the year ending June 30th, 1884:

Marriages	8,968
Births	25,263
Deaths	21,716

In the year ending June 30th, 1885, to be reckoned on an increased population of 146,917:

Marriages	8,989
Births	24,077
Deaths	23,807

Year ending June 30th, 1886:

Marriages	12,351
Births	25,497
Deaths	22,734

Population by the census of 1885:

Cities of over 5,000 inhabitants	701,428
Rest of State	576,605
Total	1,278,033

We have already considered the significence of the marriage record in a former part of the report. The marriage-rate the last year was an increase. It is to be borne in mind that a marriage represents two persons. The defects in return of births, more especially in cities, while being gradually rendered less, is still such as to require us to use the figures approximately, and by comparisons of these and of localities and of other facts, to make estimate.

In England and Wales it has been found that the birth-rate is 35.4, and the death-rate 20.5 per 1,000 persons. In Sweden the birth-rate is 30.2, against a death-rate of 18.1. In the German Empire, birth-rate 39.3 and death-rate 26.1. Austria, 39.1 birth-rate, 29.6 death-rate. The official returns for the United States show an annual birth-rate of 36 per thousand, but the birth-rate is probably much larger.

The birth-rate of this State for the past year, not reckoning the 1,469 reported still-births, was 20 to 1,000.

It is important that assessors and city clerks and physicians co-operate more fully in securing the birth returns.

The number of births is shown to have a definite relation to the prosperity and the home-life of the people.

When the times are prosperous, the number of births is greater, as well as the number of children who live.

But there are many reasons besides imperfection of return why the birth-rate does not bear a due proportion to the marriage-rate or death-rate. The tendency to hotel and boarding life instead of housekeeping and home-keeping life, the almost nomadic tendency of many young men, the increase of divorces, the fashionable views as to the evils of large families, and the too many wrong methods of limiting fecundity—all have their share of influence. A native-born population is among the chiefest material resources of a free people. Those who are studying the political and social, no less than the moral aspects of society, as patriots, as lovers of national purity and perpetuity, are beginning to feel that it is high time we took account of our heritage, and of the real value of a sufficiency of home-born and well-reared human stock as the greatest element of national prosperity. Over-production in this line has not as yet crippled any of our resources. In this State, not to speak of this broad land, there is still abundant room for homes, for that kind of thrift where a family is being reared, and where all in due time unite in the practical service

of self-support. It is not only the common law of all well-organized society and States that on an average every child pays its own way by the age of twenty-one, but statistics show that they often provide a surplus for the parents.

In a study of death and death-rates and the causes of death, the first great and striking fact is that so many children should die. There is no naturalness in child-death. But for its frequency it would have all the character of an anomaly. If any such mortality as we now experience among the young of mankind as a result of sickness, should sieze upon the young of domestic animals it would excite wide-spread attention and alarm. It is true that some of these deaths are by diseases of inheritance, but a small proportion of deaths under the age of twenty occurs from constitutional diseases. Besides, many of the constitutional diseases are amenable to the treatment which hygiene, dietetic management and physical training can afford.

In the year ending June 30th, 1886, of the 22,734 deaths, 10,610 were under twenty years of age. Thus nearly one-half die in the process of growth and fail to reach maturity. There is nothing about growth to kill. There is naturally everything that renders it surprising that death should occur in this period at all, except by accident or bad management.

As we further note the diseases, we find that 5,442 occurred from what are regarded as preventable diseases, even not including consumption and the numerous lung and brain and nervous diseases from which so many children die by ill-management.

Again, in comparing country and city, we find that a population of 576,605 outside of cities of over 5,000 inhabitants lost 1,717 children from the preventable diseases, while a population of 701,428 in cities of over 5,000 lost 3,705. Had the outside population been lost at the same rate, 3,046 instead of 1,717 would have died. Even admitting that all amid the country population were unavoidable deaths, the cities give a surplus of 1,329 unnecessary deaths. But when we come to note that there are many considerable towns and villages all through the State not included in the larger cities, one-half of these deaths would fall as among city population and show still more that our basis of comparison is itself a very excessive death-rate. Had the outside county death-rate under twenty been on the basis of that of Cape May and Hunterdon counties, 5,811 children under twenty would have died, instead of the 10,610 that did die. Here is a waste of substance and of life enormous in its proportions, and even in its

material bearing on the productive power and development of a State. All this, too, when the basis of comparison as made for Hunterdon and Cape May counties takes it for granted that the deaths from preventable diseases in those counties were not preventable.

Extending the view beyond children and all along through adult life, and taking consumption as an example, we find that 2,051 died of it in cities of over 5,000, and 1,154 in the rest of the State, and had the deaths outside of cities, from consumption, been in the same proportion as in the cities, there would have been 1,686 deaths instead of 1,154. Apply this to the comparison of various other diseases, and we see how much of the purely artificial there is in disease. Count the number of days and the sickness and the loss which all this represents, and how much it stands for of sickness and disability in those who are not killed at once or at all by the chief preventable diseases, and consider whether it will not pay for us to prevent diseases to a far greater extent than we are doing. Could we have a more significant indication of the great losses that are taking place from avoidable disease? What wonder that the medical sanitarians see that a good and efficient Board of Health is a life-saving station in every township and village, which, if it does half its duty, is yearly saving a larger quota of human beings than were ever exposed upon any one sea-coast. There is before us the accurate table of the death-rate of a city of Massachusetts, from 1870 to 1886, its population having in the meantime increased from 9,065 to over 15,000. From 1870 to 1878 its average death-rate was 17.59 per thousand, and from 1878 to 1886 15.61 per thousand. The percentage of deaths from the zymotic or preventable diseases was 26.21 up to 1878, inclusive. At that time a separate Board of Health was established. In the succeeding eight years the percentage fell to an average of 15.11.

SPECIAL DISEASES.

In the study of each special disease, and especially in the study of localities, physicians and Boards of Health are advised to make comparisons of the number of deaths for the series of years over which our tables now extend. The quinquennial tables, as contained in the report of 1883, give the first five years, and the record is continued in the reports of each succeeding year. It is only by reading the reports and comments of each year in connection that we can arrive at a just comparison of results.

While we have thus far been delivered from *Asiatic cholera*, which has caused so large a mortality the past year in countries along the Mediterranean sea, we are to remember that commercial relations may at any time bring it to our shores and afford a center for its extension. More threatening still are recent dispatches from Buenos Ayres. The ship "Perseo," plying between Genoa and Buenos Ayres, brought the disease to Rosario, where the passengers and cargo were discharged. In the cholera hospital at Buenos Ayres there were in November 200 cases and 73 deaths. In Rosario, 200 miles from Buenos Ayres, in a population of 50,000, there are reported, under date of December 3d, from 35 to 50 deaths per day. We cannot afford in the least to abate our vigilance against this disease.

REMITTENT FEVER.

Although this shows a slight increase over the former year, being 243 instead of 209 for the year ending June 30th, 1885, and 240 for the year ending June 30th, 1884, yet it is much less than the former average of 344 for the preceding five years. The prevalence is most marked in Essex, Hudson and Union counties, which had respectively 34, 56 and 16 deaths from this cause, to June 30th, 1884; 38, 44 and 13, to 1885, and 48, 55 and 22, to 1886.

There can be no doubt that this is, to a large extent, a seasonable disease, which is sure to recur in more extended endemics unless there is thorough drainage of the soil. The arresting of water-springs and water-sheds to make ponds or lakes, and the various undrained excavations that are made in and about cities, are always a source of peril. Two hundred and forty-three deaths from remittent fever point to many cases of malarial sickness of a lighter kind. With the excellent provision made under our State laws, for the drainage of localities, public enterprise and private interest should combine, better to protect our citizens against this avoidable cause of disease. The success which has attended the Pequest Valley drainage scheme should be the encouragement to much additional effort in this direction.

TYPHOID FEVER.

The quinquennial table of 1878 showed an average of 564 deaths from this disease. The record for 1883–4 was 640; for 1884–5, 642,

and for this year, 545. We believe it is not in vain that the attention of physicians is being called to this as a preventable disease, often caused by filth, by impure water, and by carelessness as to the disposal of secretions. Its occurrence is, perhaps, not less frequent than formerly, but physicians are more on the alert to prevent its recurrence from the first cases as a center. If only the public will recognize this as a manufactured disease and will unite with Health Boards and physicians to prevent it, it will have great diminution. Attention is specially drawn to the circular issued this year as to it. Also it is to be kept in mind that, with the rapid crowding of our people into cities and summer resorts, it will require no small degree of vigilance to prevent its increase. It is one of the invasions to which New Jersey is especially subject by reason of its relation to transit and to adjacent populations.

SMALL-POX.

As against the average of 138 deaths yearly from small-pox for the five years ending June 30th, 1883, and the 7 of 1884, and the 2 of 1885, the 4 of 1886 is encouraging. Of the former years the record was as follows: To June 30th, 1879, none; to July, 1880, 15, of which 10 were in Camden county; to July, 1881, 254, of which 144 were in Camden county and 70 in Hudson county; to July, 1882, 367, of which only 3 were in Camden county, 277 in Hudson, and some cases in all but 7 counties of the State; and July, 1883, 54, of which 39 were in Passaic county. A study of the locality of small-pox epidemics, and of the frequency of their occurence, shows very plainly that the most extensive epidemics are where some single case of exposure having occurred there has been neglect of vaccination. Children coming out for the first time into school-life are the most ready and the most unprotected material. An epidemic of small-pox would occur every 6 or 7 years in most places, if only some one having contracted the disease would come to the community. It always does occur occasionally in all large communities, except those in which vaccination is followed out on a system. Even among the anti-vaccinationists of Leicester, England, it has been discovered that all the nurses and attendants avail themselves of vaccination, and then protect others by complete isolation. Just at this writing there have been a few deaths from small-pox in New Jersey, and it is present both in New York and Philadelphia.

Our physicians, our school boards, our Health Boards, and the heads of families, are urged not to neglect vaccination. Circulars of direction as to procuring lymph, etc., are sent on receipt of postal.

SCARLET FEVER.

The five years' average of deaths from the disease, to June 30th, 1883, was 771. The number for the respective years since have been 547, 646, and this year 222. Of these 165 were in cities. It is probable that we shall again have this year some increase over this, but it is certain that there has been great gain in our knowledge of isolation and disinfection and in the treatment of this disease so as to save more and especially to prevent its spread. In addition to the use of disinfectants in the mouth and the oiling or other means of protecting the skin, it is recently claimed that the secretions of the scarlet fever need disinfection. As we know that the mucous membrane shares in the disease, it is quite probable that the epithelium may be a conveyancer. So it is wise to disinfect the stools of scarlet fever patients. Sir James Paget has recently said that to the works of Jenner and Pasteur "Power and Klein have lately annexed their admirable discovery of the milk scarlatina."

MEASLES.

The average of deaths from measles for the five years ending June 30th, 1883, was 115. The record for 1883–4 was 189, it having been epidemic in Hudson and Passaic counties. For 1884–5 the deaths were 135. The number of deaths for the past year was 88. It is a disease in which the number of deaths stands for a very large number of cases, since it is not in general a fatal disease. Yet since it is often accompanied with bronchial or pneumonic inflammation, and leaves an impairment of lung tissue favorable to the development of tubercle, it is never a disease to be regarded lightly. During attack an equable temperature is desirable, and after the active symptoms have subsided there must be protection from cold for a time and the use of flannel as a body covering. As it is a disease especially contagious, there needs to be guard against the contagion, and especially in the winter and spring, when the attacks are most severe. The mouth and nasal discharges from measles should be received in a

vessel having in it chloride of lime or some other disinfectant, and the mouth should be frequently rinsed with a mild disinfecting wash. Handkerchiefs used by the person should be put in hot water before removal from the room.

WHOOPING-COUGH.

Although this is generally looked upon as one of the mildest or least serious of the communicable diseases, the deaths from it are more numerous than from measles. The average for the five years ending June 30th, 1883, was 192; for 1883–4 the number was 116; for 1884–5, 181, and for 1885–6, 274. There was a large excess in Jersey City and Hudson county. It is a disease much more fatal in cities than in the country. There is good reason for guarding against it, especially in the winter and spring. It is generally caught directly from the breath or from the secretions or the dried dust thereof mingling with the air of the room. The sputa should always be disinfected. The use of anti-spasmodics and of other medicines in the early stages does much to mitigate the severity of the disease.

DIPHTHERIA AND CROUP.

In the Secretary's report especial consideration is given to this disease, and some facts recorded of importance to all observers. The physicians of the State are asked to give it closer observation with reference to the views therein suggested. We believe that by earnest and continued effort on the part of Health Boards and physicians we shall be able to diminish the frequency and mitigate the severity of this disease. The average of deaths from it for the five years ending June 30th, 1883, was 1,144; for 1883–4 the number was 1,027; for 1884–5, 1,496, and for 1885–6, 1,303.

Contrary to the claim that has been made in England and in some of the States, the cities, as with other communicable diseases, show the larger proportion. Thus of the 1,496 deaths of last year, 1,061 were in cities of over 5,000 population, and for this year, of the 1,303 deaths, 985 were in cities. Still it is a disease alike to be dreaded in city and country. It seems to rise without an antecedent case more frequently than most other of the communicable diseases. Filthy conditions, foul water, dampness and the sudden exposure of cesspool or sewer material on damp, warm days have often seemed to cause

the disease or to give to it excessive mortality. It is the most formidable enemy of child-life.. Yet in its earliest stages it is generally controlled by treatment. The most thorough cleansing and disinfection have much to do with limiting the disease. In diphtheria all the secretions should be carefully cared for.

ERYSIPELAS.

The average of deaths therefrom for the five years ending June 30th, 1883, was 111. The record .for 1883–4 was 80; for 1884–5, 74, and for 1885–6, 79. Under this we have not included pyæmia and septicæmia, which are so often the result of accident. As erysipelas is now recognized as a specific and often communicable disease, and as it often bears suspicious relations to puerperal fever, it needs to be guarded with all the care needed for contagious diseases.

DIARRHŒAL DISEASES.

This column embraces all deaths from bowel affections between the age of one month and twenty years. Those who die under one month are often put down with this as the cause of death. But as it is found that this is merely the incident among other causes that are developmental rather than functional or constitutional, they are not reckoned. The average for the five years ending June 30th, 1883, was 2,354. The number for 1883–4 was 2,462; for 1884–5, 2,845; for 1885–6, 2,664. Of the last number, 1,775 occurred in cities. The marked feature in the present year was an increase in the number of deaths from dysentery noticeable in various parts of the State. Although 109 deaths from this cause in persons under twenty years of age is not remarkable, yet it shows some tendency to this form of disease. We have before called attention to the relation of impure water to this disease. While all impure water tends to irritate the mucous membrane of the bowels, there is often in dysentery reason to believe that the irritation is of a specific character. Diarrhœa is generally caused by errors of diet or foul air. Attention is called to the article on Feeding of Infants in a previous part of this report. The effects of change of food and air, the great number of deaths in tenements and the crowded parts of cities, and the results of fresh-air funds are but so

many public notices that this class of infantile diseases is an artificial production, and the deaths the penalty for the transgression of animal laws.

CONSUMPTION.

This continues to be the great destroyer of life in the ages of manhood and womanhood. For the five years ending June 30th, 1883, the average of deaths from this cause was 3,015. The number in 1883–4 was 3,215; in 1884–5, 3,320, and in 1885–6, 3,205. The number for the last eight years is 24,817. The fact that 2,300 also died the past year of acute lung diseases makes the lung mortality very large. These latter also no doubt indicate many who recovered from an acute attack, but afterward succumbed to phthisis pulmonalis. Some of the reasons for the large number of deaths from consumption are not far to seek. Full as many are attributed to heredity as belong to it. If we examine the city mortality, and especially cities of some special trade like that of the hatters of Orange, we find that it is a very prevalent trade disease It emphasizes the necessity for skilled inspection and oversight of all factory industries. The view that tuberculosis is conveyed by the milk of consumptive cows, has also seemed to receive some more proof during the past year. There is no disease to which prevention should be more thoroughly applied. There are members of families and there are individuals, who, by reason of their history, their build, their appearance, should never before thirty years of age be consigned to city life or any indoor occupation. Intelligent supervision and skilled examination beforehand would save very many from invalid lives or early graves.

School life is also believed to be accountable for much of the lack of lung vitality and full expansion which is so common a condition of our American youth. We have intermingled with it none of the military training to which so much of the European population is subjected. We must make up for the absence of this normal exercise by definite physical training of some kind. Also every school-room needs to be studied in its relation to the health of pupils. Education into robust life must be made a specialty as much as any other department of development. It is high time that scholastic and civic and governmental attention be more directed to a disease acquired oftener than it is inherited, and prevented oftener than it is cured.

ACUTE LUNG DISEASES.

Of these pneumonia is the most formidable, although many bronchial and pleuritic affections add to the list. The average of deaths therefrom for the five years ending June 30th, 1883, was 2,373. The number for 1883–4 was 2,174; for 1884–5, 2,566, and for 1885–6, 2,300.

Our variable climate, the indoor life of so many of our people, the exposure of trades, the use of alcohol and carelessness as to the adjustment of one's self to changes of temperature, have much to do with this mortality. The keeping the mouth closed in sudden change of air, the using of the nostrils instead of the mouth for breathing purposes, the increase of flannel when outer garments are changed, the protection of the back of the lungs as well as the front, and the avoidance of the depression of vitality which foul air always causes, are among the precautions to be suggested.

BRAIN AND NERVOUS DISEASES OF CHILDREN.

The average of deaths from these, for the five years ending June 30th, 1883, was 1,722. The record for 1883–4 was 1,598; for 1884–5, 1,791, and for 1885–6, 1,774. Here, again, there is need of close study and observation in dealing with children in our schools. It is rather spasmodic over-pressure than continuous over-exertion. There is also much error in not early recognizing the presence of some form of functional derangement, and meeting it by dietetic and hygienic treatment. Too often some defect of vision is not early enough recognized, and is the means of causing irritation either of the brain or general nervous system. A large proportion of these deaths is found to occur in cities.

DISEASES OF THE HEART AND CIRCULATION.

Of these the average deaths, for the five years ending June 30th, 1883, was 1,115. The record for 1883–4 was 1,324; for 1884–5, 1,503, and for 1885–6, 1,506. The city record for the last year was 838. The country districts receive a little more than their share of death-record from heart disease and adult brain disease, because so

many thus invalided retire from business to country homes. There seems to be a gradual increase of diseases of the heart and circulation, in part probably owing to the more exciting and exacting demands of business life. Young men are more rapidly forced into active business relations, the speculative type even invades the domain of systematic trades and industries, and anxiety or excitement cannot but affect our inner circulating medium and the organs that convey it. Some statistics seem to indicate that the use of salicylic acid, and the quicker dealing with rheumatism, make it less a cause of heart impairment than formerly. Experience is showing that valvular disease, and some other forms of heart or artery disturbance, are not so fatal or so limiting of life as formerly, if only there is adjustment to the impairment and a more quiet or uniform life.

URINARY DISEASES.

The average of deaths from these for the five years ending June 30th, 1883, was 640; for 1883–4 the record was 892; for 1884–5, 939, and for 1885–6, 926. On our original sheets we distinguish between those that affect the kidneys, and those that affect the bladder only. Most of the cases are those of organic disease of the kidneys, so often associated in mortality records under the name of Bright's disease.

No organ of the body is more intricate or more perfect as an alembic or laboratory, and none is less likely to be organically changed if there is conformity to the laws of our being. But between alcohol, Cayenne pepper, catsup and various stimulating and irritating juices and condiments, it is not wonderful that the minute capillary vessels of these two organs should become inflamed and change of structure take place. We believe that proper dietetic management would prevent or postpone many deaths occurring from this disease.

ADULT BRAIN AND SPINAL DISEASES.

The average of deaths from this cause, for the five years ending June 30th, 1883, was 1,449. The record for 1883–4 was 1,664; for 1884–5, 1,895; for 1885–6, 1,932. This uniform increase is significant, and has some of the same causes alluded to under the heading of heart disease. These are cases not to be met by the methods used

for communicable diseases, but have their remedy in a practice of such laws as relate to the care of the animal economy. They are a sad comment on that wastage of human life, which occurs either from overstrain or from a lowering of the general vitality of the people.

DIGESTIVE AND INTESTINAL DISEASES.

The average of deaths from these, of persons over twenty years of age, for the five years ending June 30th, 1883, was 957. The record for 1883–4 was 1,075; for 1884–5, 1,140, and for 1885–6, 1,213. Of these last, 111 are marked "Dysentery." The increase is about in proportion with the increase of population. Not only the theory of digestion, but the management of diseases of the digestive organs, is better understood than formerly. If this record be added to that of diarrhœal diseases, it is evident how many deaths occur from improper foods and disorders of digestion. The remedy is largely in self-restraint, and in a knowledge of the laws of health among the people.

CANCER.

The average of deaths from it for the five years ending June 30th, 1883, was 423. The record for 1883–4 was 484; for 1884–5, 498, and for 1885–6, 546. The English tables also notice a somewhat surprising increase of this affection. As the diagnosis of cancer from other forms of tumor or sore is not always easy, no doubt the number is somewhat exaggerated. But, nevertheless, the increase should attract the attention of all investigators of disease.

ACUTE RHEUMATISM.

The average of deaths from this cause for five years ending June 30th, 1883, was 64. The record of 1883–4, was 62; of 1884–5, 36; of 1885–6, 68. While not a fatal disease, it often leaves some impairment of vital organs. It also shows a relation to states of weather and to seasons. It is to be studied especially in climatological relations, as also in its relation to the digestive apparatus.

PUERPERAL DISEASES.

No diseases need more careful watch than those which imperil the life of mothers. All the more because the element of contagiousness is so prominent and so many a life is sacrificed to want of caution. The average of deaths for the five years ending June 30th, 1883, was 237. The record for 1883–4, was 221; for 1884–5, 268, and for 1885–6, 257. The number last year not directly connected with childbirth was 41.

ACCIDENTS.

Last year we added a special note as to the number and variety of avoidable accidents. The number for 1884–5, was 837; for 1885–6, 997. While this column as printed includes all accidents and suicides, it shows a loss of life from this cause requiring the most careful attention. We have already in the report of the Secretary drawn attention to the drowning record. The prevention of railroad and drowning accidents and of accidents from machinery needs to be carefully studied with a view to prevention.

While the record of the year, taken as a whole, is more satisfactory than that of some years, the student of vital statistics cannot but see the general uniformity of indications as to the mortality from various diseases, and appreciate more than ever before how many deaths occur which might be postponed or from causes which might be removed.

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REPORT OF THE SECRETARY OF THE BOARD.

To His Excellency Robert S. Green:

GOVERNOR—The State Board of Health of New Jersey begs leave to present to Your Excellency its eleventh annual report. The report of the Bureau of Vital Statistics as appended to this report furnishes the details as to the health of localities so far as indicated by statistical returns. In each annual report these can only be tabulated up to the previous first of July. Additional facts as to the health of localities are appended by the annual reports from local Boards, generally received about November 1st. The returns will show some increase over the average of deaths for five years past. Besides the constant tendency to the accumulation of insanitary conditions, fostered by the rapid growth of our cities and the increase of population at the termini of our river systems, our State is constantly exposed to those communicable diseases which are so easily spread where interchange of travel and traffic is so active.

While there have been many local outbreaks of diseases of this class they have in no case reached the proportions of a wide-spread epidemic. Their restriction has in some instances been plainly traceable to the efficiency of local Health Boards.

During the year many of the Boards have profited by important changes made in the health legislation of the State and have adopted ordinances or codes which secure more effective administration.

Our own experience, as that of other states, confirms the judgment so often expressed abroad that a large number of diseases are preventable, that others may be greatly circumscribed in extent and fatality, and that the general comfort and expectancy of life may be largely augmented.

Besides the appeal such conclusions afford from our desire for personal health and happiness and our interest in the general welfare of our people, the material value of health and life is coming to be more highly prized. Sir John Simon, formerly medical health

officer of the Local Government Board of England, gives it as his well-established conviction, which is accepted as substantially correct by English writers, that in each year the deaths in England were fully 125,000 more than they would be if existing knowledge of the chief causes of disease as affecting the masses of the population were reasonably well applied.

Sir James Paget, a former President of the International Medical Congress, thinks, from the study of reliable data, that the annual loss of time by sickness for the entire English people is one-fortieth of the work done, or nine days in a year for each man, woman and child between the ages of sixteen and sixty-five years. This would be an annual loss of time by sickness for the whole kingdom of about 20,000 weeks. This at $5 per week is an annual loss of $100,000, not counting cost of sickness.

The preventable deaths that occur from typhoid fever and consumption alone take from the resources of the country more than its entire health administration costs.

Mr. Gladstone, in a recent address at the opening of the drainage works in Herndon, England, said: "There is no greater economy than the saving of human life." Added to the saying of Sir William Jenner, that "The value placed by a community on individual life is one of the great tests of the state of civilization," it affords an additional motive for the most liberal attention to a support of measures for protecting our citizens from the personal, social and financial embarrassments of invalidity, disability and death. This Board, as it reviews the experience of many years, can perceive that something has been done the better to protect our citizens from the avoidable causes of sickness and to appreciate the life and comfort of our people. But as it also sees the possibilities of the future, how a complete sanitary administration extended to every hamlet and city of the State, protecting the people in their persons, in their homes, in their schools and in their places of industrial occupation, would add to lives and population and to the happiness and the resources of the people, it feels that it only has illustrated what the future may accomplish, if only the sentiment of people or legislators is equal to the needs and possibilities of the work. Science and the applications of art, and the knowledge of economical, sanitary construction and administration are far in advance of the actual applications of such knowledge. If to-day the means were afforded to this Board and to the local Boards, to

carry out and apply what is proven as to the practicability of life-saving knowledge, we should each year add, for the welfare of our population, hundreds of preserved lives, thousands of effective working days, and material capital and an amount of increased happiness beyond numerical statement. While the Legislature has well responded to appropriations sought, we fear that on our part there has been too much conservatism and too great timidity as to asking that aid in broader methods and more thorough administration, which is justified by all the facts in evidence as to the individual and material advantages of such extension to the State at large. Most of our cities are still far behind in the details of approved sanitary administration and in those financial provisions, therefore, which are necessary for the health and prosperity of the people. In the work of sanitary inspection and advice, and in the general oversight of the health of the people, we find a field of operation which might be largely extended to the great advantage of our citizens. Neglects which involve the health of the growing population and insanitary conditions which affect thousands of operatives, as well as defects in the homes of the people at large, arise, because there is not a general recognition of the limitations they cause upon effective industry and general welfare.

In many cases, too, local Boards, while having a general conception of the situation, need to be urged to greater activity of administration and to be more liberally provided for by their respective constituencies. We herewith draw attention to a few of the subjects that are worthy of special consideration and append thereto special papers and communications.

DRAINAGE FOR HEALTH.

The relation of soil conditions, and especially of the circulation of water in the soil, to the health of those residing near it, is more and more attracting the attention of sanitarians. The climate of a locality has very much to do with health. This is largely influenced by the ground moisture. The observations of Buchanan and Bowdich as to consumption long ago showed this. Much additional information has been collected as to its effect in producing fevers and rheumatism. Besides, there are various forms of gastric and intestinal disturbance dependent on dampness or those quick alternations of temperature that leave wet ground very cold while the surrounding air is heated.

Where drains have been so constructed as to dry large surfaces, the effect on health has been most marked. In cities where sewers are constructed one of the frequent benefits arises from the drying of the soil. Each State and each portion of it needs to be studied as to plans for its drainage.

The first thing is to study thoroughly the geological structure and the localities of drift. It is not sufficient to have a general idea of the trend of the strata. When draining in populous districts, and with reference to health, the underlying condition needs to be as well known as if it were mapped on the surface. Recently, in the location of two cesspools, the fact of a drift deposit was overlooked. The result was that the reliance placed upon the grade of the shale was deceptive and the fall was into the building. We know of another section in which the trap rock has here and there pockets beneath the surface filled with organic matter, causing much ill-health to those who locate on the fair surface. No system of drainage is skillfully laid out unless the sections are thus well described.

Next, the natural water-shed should be well known. Localities which seem favorable as to their soil and general contour may be the natural receivers of great amounts of moisture. They are kept constantly wet by their surroundings. So, in order to dry them, the drainage must be around them rather than upon them. This is generally spoken of as cutting off the springs. It is often more than this and involves the cutting off of rivulets all around. Also, the surface may be so located that the surrounding surface-water needs to be headed off and turned in another direction. It is surprising how often these simple requirements are overlooked. The city builder is not able readily to decide as to the strata or take in the general surroundings. Mistakes are even more common in cities than in the open country. The engineer who knows thoroughly the ground structure and the topography and the history of adjacent water-courses, had made the first step toward a complete system of drainage.

Next comes a knowledge of the amount of rain-fall and the usual time of its disposal. The observing farmer comes thus to know his different spots of land and often adopts wise methods of regulation. There must also be some knowledge of contour and of the relations to light, air and sun heat. A heavily-shaded hill is often wet when a valley well exposed to the sun is dry. The old plan of facing or locating buildings with reference to sun and winds and exposure,

rather than to correspond with the direction of the road, was wise. In drainage for building purposes more regard should be had to the effect of the sun in keeping the soil dry. Shade and dampness have great relations to each other.

Observation as to the position of springs, and as to the depth of wells, and the varying height of the water in them, is of service in determining ground water-levels. Where the water in the well rises to a height parallel to the depth of the cellar it is generally a sign of imperfect drainage, unless there is change of strata between the house and the well. The area of fogs also is an indication as to surface moisture.

We also need to consider forests in their relation to moisture as well as to rain-fall. While the preservation of forests has important relation to rain-fall and its distribution, large adjacent forests increase dampness. So the local dryness of soil is often promoted by the removal of forests and the tillage of the ground. Sometimes, however, single trees of large foliage and wide-spreading roots aid in the drying of particular spots. Artificial excavations and embankments make many changes in the underground water-level as well as in general dryness of the surface. Each cellar acts as a drain to the surroundings. Embankments, even when having the attractive name of terraces, often add to the dampness about dwellings. Railroad embankments not infrequently change the water-level of the ground, while the excavations serve as drains. We have known the water-level in small lakes or ponds so changed by the buildings about them as by their dryness in summer to become a menace to health. All such artificial changes are to be taken into consideration, not only in reference to particular buildings, but also in reference to the drainage of broad areas. There also needs to be knowledge of all underground or surface drainage of an artificial kind. Often because no maps have been made or preserved these are lost sight of, and such obstruction takes place as reproduces the condition of things that existed before drainage. Even the contour and topography of the surface, and changes that have been made to govern the flow of surface-water, need to be carefully studied. Nothing is more common than to trust merely to the eye, which is often deceived by the comparison with the surroundings.

We should be more fully aware of what great physical and pecuniary advantages accrue from well-devised systems of drainage, or

from local drainage about buildings. Even where there is not enough fall, well-laid drains a little distance away, withdraw some of the water from the vicinity of the house. In draining the grounds for the hospital buildings of Johns Hopkins University, at one point it was found necessary to go through several layers of impervious strata, so as to reach a gravel and sand-bed which was near a stream. By centering the termini of many drain-pipes to this drainage-well a large and wet area was thoroughly dried. Ground drainage has become so perfect an art, and the evils of damp and wet soils to the public health have become so established that every city should give its first consideration to ground drainage. Dry soils have a capacity for disposing of refuse to a degree that is of very great service in crowded localities besides the direct advantages of dryness. Where a house has already been located on a spot where there is a lack of fall, and where the remedies already named cannot avail, an area should be formed around the building, and the cellar wall cemented inside and out, and a cement floor provided. Former reports have given many details as to the modes and results of efficient drainage, but it is important thus to emphasize its necessity and its advantages, and its essential bearing upon the public health.

DISPOSAL OF FOULED LIQUIDS.

So much attention has been given in former reports of this Board to the various methods for the disposal of liquid wastes from houses, that it ought not to be necessary to do much more than to refer to what has been said upon this subject. We have thought best in this report to direct attention more technically to plans and systems as in actual operation in this State. Specimens of the most of these are described by those who have constructed the work. Most of the more approved methods are now more or less in use in the State, and can be personally examined by those who desire to compare methods. It can be said of nearly all methods that their value is *relative*, depending upon adaptation to the locality or the number to whom they are supplied. Even in private homes, where large systems cannot be applied, many improvements are being made. The farmer has learned that deep vaults are not needed, and that it is not only slovenly but hazardous to health to have the out-house the common receptacle of

slops, or to have it at all connected with any water-closet in the house. The material thus kept dry is easily disinfected if there is odor, and easily removed and composted. If slops cannot be disposed of on the ground or in trenches between rows of rank-growing crops in the rear of the lot or on the horse-manure heap, frequently enough removed, it is better to trust to a small separate cesspool, not deep, and either arranged for surface soakage with easy access, or made tight by cement, and to be emptied by an odorless excavator. If a hole is made in the ground about six feet by four, or circular, with a depth just sufficient to be below the ordinary frost line, and with rows of agricultural tile extending from its bottom several feet in every direction, it will dispose of a good deal of the ordinary slop and wash and bath waste in its *fresh state*, and so be no hazard. The two great mistakes are to pond such materials in cesspools, where they become harmful, as they would not if used fresh, and in making the holes so deep that nature and vegetation cannot dispose of them. It now seems pretty well established that the process of nitrification is more the natural method of disposal of such wastes than simple oxygenation. This former process is chiefly conducted by the microphytes or micro-organisms which operate only in the upper soil, and not beyond a distance of two or three feet. The depth of such excavation should not be over two feet. Careful covering in the winter will protect from frost, and in summer free access can be had if cleansing or disinfection becomes necessary. The beginning of these branch tile drains should be protected by wire baskets, which may need occasional cleansing. The pit, however, should never be used for water-closet discharges. Where there are no sewers the two most important rules are, not to unite into one receptacle the various liquid and mixed offalings of animal and household life, and not to store any of these liquids so as to undergo changes which are hazardous. In addition to methods long and favorably known in certain localities, various modes of precipitation of sewage are more and more attracting the attention of sanitarians. This is not because the method is new, but because chemistry has acquainted us with new agencies, and mechanical ingenuity now enables us to deal with the precipitant more easily. Thus the Johnson Filter Press and some other similar arrangements enable us to reduce the bulk of this settling or sludge, so as to render it quite dry, and so to compress it as that it may be sold in the form of cakes, which are easily handled and transported. The system is also often

combined with others with advantage, as where an effluent becoming too foul for the stream into which it has been passed, is thus made much more clear of organic matter, or is in addition passed upon land for intermittent filtration. In this case much less land answers for the purpose than if the waste, overladen with organic matter, had been directly carried upon it. Even where temporary cesspools seem unavoidable, the use of milk of lime, alum and other precipitants does much to arrest changes and to diminish the risks of injurious effects.

More recently what is known as the Röckner-Rothe method has come into considerable prominence. It is thus described in the *Sanitary Record* (London, April, 1886):

"The process consists in conducting the water into wells, over which the apparatus is erected. This is an iron cylinder, closed above but open below, where its margin dips beneath the surface of the water. A lateral pipe near the top of the cylinder carries off the purified water into an adjoining conduit or reservoir, and the cylinder is surmounted by a pipe connected with an air-pump, by which the air in the cylinder can be exhausted, so that the water rises gradually in its place and at length flows out at the lateral discharge-pipe, when it is only necessary to maintain the pressure constant from day to day. The level of the surface in the pure-water reservoir must be kept a little lower than that of the conduit which brings the foul water to the well, in order that the syphon action may not be reversed, and the lower edge of the cylinder must be lower than the sill of the effluent channel, to allow for variations in the level of the water.

"The height of the cylinder must obviously be less than 30 feet, and 24 feet is found the most convenient; while that of the suction-pipe must be at least 35 feet, in order to avoid the possibility of drawing the water into the air-pump and deranging the whole apparatus.

"The rate at which the water rises in the cylinder depends on the diameter of the latter and on the quantity of water entering the well in a unit of time.

"The outlet-pipe is made larger than the ordinary discharge would require, in order to facilitate the disposal of large volumes of water during heavy rains, but its aperture can be adjusted to circumstances by a sliding valve.

"The rate at which the water rises is usually 2 to 9 millimetres per second, but, being dependent on its specific gravity, varies as the weight of impurities to be removed.

"To maintain the velocity and movements of the water as nearly uniform as possible in every part of the apparatus, the foul water is

admitted by a pipe opening at the bottom of the well, which is shaped like an inverted cone. Over and around the mouth of this inlet-pipe is a funnel-shaped louvred wooden frame which divides and distributes the ascending stream.

"While the whole mass of water is slowly rising in the cylinder the heavier suspended particles subside to the bottom of the well, where they act as a filter for the entering water.

"The sludge is removed from time to time by a chain-pump and deposited in an adjacent basin, whence the superfluous water drains back into the well. The floating impurities, greasy matters, &c., are run off periodically by a second and smaller outlet-pipe close to the roof of the cylinder and discharging into a separate tank. Gases rising into the vertical pipe at the summit of the cylinder, are drawn off by the air-pumps, and burned in a furnace.

"The Röckner-Rothe apparatus occupies very little space compared with the ordinary precipitation and subsidence basins. Unlike those processes in which the sewage, &c., stagnant and fermenting for days in the settling tanks, give out pestilential odors, this is devoid of anything approaching to a nuisance, and in the entrance of the water through the bed of sediment deposited on the bottom of the tank, we not only have a form of filtration unknown in other systems, but the water is brought into contact with the chemicals which always tend to sink, without the necessity for agitation, and the motor power required to effect it. Thus the Röckner-Rothe process, with its rapid and simultaneous chemical treatment, subsidence, and filtration, conducted in closed or covered chambers, is free from anything of the nature of a nuisance, and practically without smell.

"The removal of the sludge is the heaviest item in this as in other systems, but might be considerably reduced if a not too costly means could be found for expressing the greater part of the retained water. [This is now found in the filter press processes.] In no process of clarification can chemicals be dispensed with, but for the Röckner-Rothe all are equally applicable.

"As to the expenditure on steam power required, the experience of Essen points to half an hour daily for working the air-pump and three hours for the dredge to each cylinder. No great power is needed, and it is not impossible that the current of water in the culvert might be made available as a motor.

"The sewage of Essen in rainy weather is not more than 18,000 cubic metres, which four cylinders 7 metres high and 4.2 metres wide in wells 5.5 metres deep and wide would be able to treat, reliefs or overflow culverts being provided for heavy storm-waters. The Corporation have arranged with Messrs. Rothe for the erection, free of cost, of one such cylinder, the well and all subsidiary works being undertaken by the local authority. This single cylinder has treated 4,500 cubic metres of sewage daily, yielding three litres of sludge, containing 72 per cent. of moisture, to each cubic metre of sewage.

The total sludge per annum for a daily average of 12,000 cubic metres of sewage would thus be about 13,200 cubic metres. It is too early to judge of the marketable value of the sludge, but it is hoped that it may be found available for agricultural purposes.

"Dr. Kayser estimates the value of 1,000 kilogrammes of sludge with 65.45 per cent. of water at 5*s.*, which would give an annual revenue of £3,250 for 13,000 cubic metres, but Dr. König, of Munster, in view of the difficulty attending the transport of the sludge in its wet state, suggests that it might be dried in the air, without much additional trouble, until the water was reduced to 25 per cent., when it would contain from 0.5 to 0.7 per cent. of nitrogen, 0.7 to 1.0 per cent. of phosphoric acid, and 18 to 24 per cent. of carbonate of lime, with a value of 10*s.* per 1,000 kilogrammes reckoned on the nitrogen and phosphoric acid only.

"Careful estimates of the cost of chemicals, working expenses, and the interest and repayment of the capital sunk give a total of £3,000 per annum, or 1*s.* per head of the population, which is approximately the same as the value assigned to the sludge and precipitate by the chemists König, Kayser, and Brockhoff.

"Dr. Brockhoff remarks the little disposition to putrefaction shown by the effluent, which is explained by the bacterioscopic observations of Dr. Wahl, who found the colonies developed in each cubic centimetre of the original water to range on different days from two to five millions, and those in the effluent from 34 to 178."

The number for May, 1887, adds as follows:

"Numerous analyses have shown no appreciable pollution of the water of rivers into which the effluents of sugar refineries, breweries, and other works have been passed; nor, in the case of Essen, even where sewage has been so treated. Drs. Otto and Beckurts, examining the sour and extremely putrescent waste of the Brunswick brewery after this treatment, found it free from all visible suspended particles —from albumen, sugar, and dextrin—and perfectly stable even under conditions most favorable to fermentive and putrefactive changes. The effluent contained (they report) neither ammonia, sulphates, nitrates, phosphates, nor products of putrefaction; and though it was rich in dissolved organic matters it did not acquire any offensive odor after being kept for long periods in closed or in open vessels. The precipitate, on the other hand, contained so large a proportion of phosphates and nitrogenous organic matters as to promise to be of considerable value as a manure. At Rossla the waste from the beet-sugar works, containing often 50 per cent. of organic solids, was rendered perfectly clear, and free from any tendency to putrefaction.

"We have already (*loc. cit.*) given some account of the apparatus set up at Essen for the treatment of the town sewage, and of the

financial and sanitary results. Suffice it here to say that the subsequent success has exceeded the expectations of its promoters; the sale of the sludge for agricultural purposes has, too, gone far towards reducing the very moderate cost of working.

"In an analysis of the Essen sewage by Dr. Kaysser, of Dortmund, the suspended organic matters were found to be reduced from 366 milligrammes per litre to 12.6, the inorganic from 252 to 5.7, and the nitrogen from 155.4 to *nil*, the suspended nitrogen representing in great part the substance of bacteria. The dissolved matters dried at 100° C. from 1,390 to 634, mineral from 756 to 419, organic from 265 to 89, ammonia 42.6 to 11, inorganic nitrogen from 29 to 13, and sulphuretted hydrogen from 10.2 to 0. The lime, of which there were 70 milligrammes in the sewage, amounted to 281 in the effluents, 7 of which were in suspension, and 46 adhering in the solid state to the sides of the vessel, leaving 228 in solution.

"Three samples taken by Dr. Brockhoff of crude and of purified sewage gave, when kept in open glass vessels, results in striking contrast. After four days the former were of a yellow-brown color in active putrefaction, emitting a strong odor of sulphuretted hydrogen and other offensive gases—a condition which, even after filtration, persisted for three weeks, and only abated after the end of the month. They swarmed with bacteria, the great majority of which were spherical, and aggregated in masses, the bacilli being comparatively few and small. There was also a large proportion of fatty and tarry matters and a deposit of blackish slimy matters after the completion of putrefaction, showing the failure of merely mechanical filtration to purify such water.

"The three samples of the effluent, on the other hand, were on receipt, or four days after having been taken, nearly clear, neutral in reaction, with only faint traces of ammonia or sulphuretted hydrogen, and with a slight odor as of fresh urine. Even after standing six weeks in open vessels they remained scarcely altered, and the insignificant deposit consisted mainly of particles of chalk. There were very few bacteria and no fatty or tarry matters: the bacteria, indeed, were not more numerous than in many waters considered potable, and after two months the samples were as fresh, odorless and clear as when first received. Still more recent analyses of the same effluent made in the laboratory at Bonn gave the following results:

"In each 1,000,000 parts by weight of suspended matters—

	Crude Sewage.	Effluent.	Increase or Decrease per cent.
Nitrogen	17.1	4 3	— 75
Carbon	259.1	28 5	— 91
Lime	2.0	38 0	+1,°00
Phosphoric acid	2 8	1.5	— 47
Sulphuric acid	2.1	0.0	— 100
Iron oxide and alumina	15.4	0.3	— 100

"In each million of the effluent—

Carbon	152.0	164.9	+ 8
Organic nitrogen	21.2	18.5	— 13
Nascent ammonia	25.2	18.5	— 27
Sulphur	30.8	25.5	— 18
Sulphuric acid	61.7	122.1	+ 97
Phosphoric acid	15.0	1.0	— 94
Chlorine	116.8	128.9	+ 10
Lime	100.0	246.0	+ 146
Magnesia	12.9	7.2	— 45
Iron oxide and alumina	7.6	0.0	— 100
Potash	48.9	53.2	— 10

"The results of keeping were the same as before, the effluent being only slightly clouded for a time, through the deposition of chalk, developing very few bacteria, and emitting no smell worth noticing. Though not absolutely free from sulphuretted hydrogen, it contained none of the sulphides which evolve that gas on exposure to the air, the sulphur recorded in the analyses being wholly in organic combination. The remaining salts, chlorides, sulphates, phosphates, &c., would, indeed, be favorable to the growth of plants, and no fears need be entertained of any injury to meadowlands from irrigation therewith.

"Careful gelatine cultures on Koch's method with the crude sewage, diluted in the proportion of 1 to 100,000 and 1 to 1,000,000, and with the effluent diluted in those of 1 to 1,000 and 1 to 10,000, showed in each cubic centimetre of the former when fresh 1,728,000 colonies, and after four days 12,750,000. Under the same circumstances the effluent showed 108 and 8,200 respectively. In other experiments the mean results after three days were the development in each cubic centimetre of the crude sewage of 2,980,000 colonies, and in two samples of the purified of 198 and 89 respectively.

"Drs. Blasius and Kaysser found that the number of such germs in the sewage differed greatly with the hour of day or night, the water being foulest at 9 A. M., and least so early in the afternoon. The colonies obtained varied accordingly from 1,686,000 to 5,245,000, and in samples of effluents from the same from 34 to 178, though not always in corresponding ratio.

"A very important observation, and one tending to enhance the value of the process, was that the best results were obtained when the apparatus had been some time at work, for until the sludge had accumulated sufficiently to act as a filter the number of colonies was considerable, being within a few hours of starting as high as 130,000 to 160,000."

Chemistry, mechanics and experience are each year adding to our practical knowledge of methods of dealing with the various forms of waste incident to households, factories and all that results from the

aggregation of large populations. If only there could be more care on the part of individual householders and more thorough administration, it would be found that science and art are equal to most of the needs of healthful life, and that death-rates and sickness-rates could be greatly diminished. This means that labor would be more successful; the population more vigorous, and the people at large be more prosperous and happy.

THE DISPOSAL OF SEWAGE WITHOUT SEWERS.

It will always happen in rural districts, and in many of the smaller towns and cities, that sewers are not provided. Therefore, dependence will have to be placed upon other means of delivery and disposal of house wastes. This, therefore, becomes a subject by itself, and all the more because of the tendency to provide so many houses with what are called modern conveniences. It is a sad irony upon human progress if these improvements afford us unexpected facilities for getting out of the world by artificial methods. The rule is so firmly established, that we are not to store our waste and live amid or over it, that we cannot be too skillful in devising means of riddance. And it is very important that these be such as can be easily managed, and such as are within the pecuniary reach of the ordinary citizen.

The first great rule as to all refuse lodged within the house, is to get clear of it before it can undergo any process of decomposition. It is one of the most conservative facts in nature that fresh material of any kind, whether it be excretion, refuse or offaling of any kind, is harmless, so far as disease is concerned. Even where a natural, unpleasant odor is imparted, it seems as a provision for notification, before any injurious results can occur. While this is not true as to the skin diseases that are communicable, it is even true of most of the secretions of diseases. If, therefore, no material of the day is allowed to remain in the house by night, and that of the night is removed in the morning, we have a great protection from diseases. The next most general rule is that there should not be mixture of various different products. While we make an exception with some things because of the availability of water as a means of conveyance, the rule mostly holds good. This habit of separation enables us to know in each case just with what we have to deal, and thus we are more likely to deal with it more promptly. We thus have no concealment

and call things by their right names and dispose of them accordingly. If the mass accumulates under the general name of an ash-heap, it is quite likely that it will be stored or overlooked as such. The next rule is to make the amount of collection as small as reasonable, and to dispose of as much as practicable by means of fire. We know a prominent health officer who so manages all dust, all peelings, all parts removed from vegetables and various other scraps as with very little trouble to pass them from the dryer to the kitchen fire.

Where there is a bath-tub, the water from it, if there is not a sewer, should not go into a common receptacle. It can be carried by a pipe of its own away from the house and seldom needs a cesspool. If it does, it can be of the most superficial kind. The same is true of the scullery and kitchen wash. If it amounts to much, there should be an outside grease-trap, and then this water, too, may pass to a very superficial and temporary cesspool. Then the product from the inside closets, having a receptacle of its own, will be so reduced in bulk as often to be relieved of its liquids by natural soakage, and so not be troublesome. It is our attempt to dispose of all in one way that generally makes the complication. We have often noted how, in this separate or separating system, even surface disposal causes no embarrassment. The grape vines or the bushes at the foot of the garden, readily care for the richer liquids, or trenches between a few short rows of sowed corn or oats receive so much of the liquids as have any undissolved matters, and they are quickly gone.

Where there is need of any cesspool system, we have lately found that two or three adjacent and superficial ones are far better than the deep vaults that were formerly in use. Since we have come to know that the chemical and biological changes of effete matter are carried on only near the surface, the chief indication is to place the material in reach of the transforming processes of nature. There is a great deal of unnecessary storage of foul liquids in large cesspits.

In an institution of over two hundred persons, we some time since had occasion to provide a simple method of caring for the waste. The edge of some rolling ground far enough from the house was favorable to the digging of a ditch in which, at different points away from each other, the house-pipes could enter. From its lower side frequent underground drains of land tile were extended. These were so provided with small wire baskets, such as are used for water-leaders, as to prevent the entrance of rags, paper, &c. During the winter,

the whole was protected from the frost by a covering. We were surprised to find how available was so simple a method. It is very rarely that a lot having a depth of one hundred feet needs a cesspool, if only the methods we have indicated are adopted. We cannot but urge upon householders who possess only so little land to avail themselves of these natural and simple methods of disposal. The only limitation is where the water for drinking has to be obtained from shallow wells. Even then this surface method avails unless the amount of material is great and the depth of lot does not allow a distance from the well of at least fifty feet.

GAS, WATER AND SEWAGE HOUSE-PIPES AND CONNECTIONS.

In the present fitting up of most city and many country houses the various pipe systems play an important part. The gas-pipes, the water-pipes and the soil sewage or waste-pipes are the three principal divisions.

Leakage of gas is a far more frequent cause of air contamination than is generally supposed. The carbonaceous, sulphurous and other gases which are too often mingled with the illuminating-gas cannot but be injurious to the persons who too constantly breathe them. Often there is escape which is not noticed by the residents. The two following directions for securing the perfect fitting of all gas house fixtures have the sanction of so good an authority as Mr. Eassie:

"A gasfitter *who is a gasfitter*, and who understands his business, will never take leave of a house until he has tested the pipes for leakage. Where this trouble is taken, the ordinary practice amongst us is as follows: When the pipes have been laid throughout the house, and the company's main connected to the meter, a temporary burner is fixed to each floor of the house, and the gas is turned on. The gas is now ignited at these trial jets and allowed to burn for some little time. The main is then turned off, and at the same time the exact reading of the index is taken. When the gas left in the pipes has burnt out, the taps of the experimental lights are turned off, and if, after the lapse of an hour or so, the dial of the meter continues to indicate a consumption of gas, it is plain that it somewhere escapes, and the leak is searched for by the sense of smell, &c., and remedied."

Another description of method is as follows:

"Before the gasfitter asks the gas company to make the connection with their main, he sets about proving the pipes. He stops up, with

one exception, all the outlets which have been left for brackets and pendants with plugs or with screwed caps. On the one not so stopped he attaches a force-pump, into the interior of which has been put a few drops of sulphuric ether. This pump is now connected with a gauge, and it is then set to work, generally until a high pressure is registered. A high pressure in a gas-pipe at first appears unnecessary, but gasfitters know very well that iron pipes have many latent weaknesses, so to speak—seams just ready to open, pinholes filled with grease, &c., which might not drop out for years, and a good pressure exerted would rip up the one and cause the others to fall out. When the gauge indicates a certain figure, therefore, the pumping ceases, and if the mercury falls, it is evident that there is one or more palpable leaks, which are at once sought for. The escaped ether will guide the fitter to these, and the defaulting pipes are replaced by others. The pumping is now continued, and the same routine recommences. If the mercury still descends and it cannot be detected, even by the sense of smell, the joints are separately lathered over with soap, whereupon the weak places will be indicated by bubbles. These parts are then marked, heated by means of a portable spirit lamp, made for the purpose, and covered over with an approved and durable cement. When the inspector arrives, the pump is once more set in action, and as the pipes are now tight, he has simply to cast an eye upon the gauge, the column of which no longer shows signs of sinking; examine, as before mentioned, how the pipes have been laid, and sign the requisite order."

The imperfection of *water-pipes* is generally discovered by the wetness. But this leakage may be in inaccessible places, and so the ground be kept soaked. Great care should be taken in the original construction, and there should be occasional inspection. Where there is a cistern, too often the overflow-pipe runs to the house soil-pipe, and thus, for most of the time, is a conduit for foul air to the cistern. Where this pipe has a trap, the trap has no water in it, and so is of no service. The effects of lead pipes we have considered heretofore.

Where the closets and other apparatus are directly connected with the water-supply, without an intervening automatic tank, there may be some absorption of the gases of decomposition by the water. Whether so or not will depend much on the cleanliness of pipes and fixtures. Their cleanliness depends mostly on the water-flush and the free access of air, so as to secure currents and circulation. There is also need of occasional inspection and the usual cleansing at the time of house-cleaning. We have yet to see any form of plunger-closet that does not need this occasional cleansing.

The pipes which, with the various attachments, constitute the house sewer system, are those which especially need to be guarded against any leakage or such imperfection in use as will favor the retention within them or on their surfaces of decomposing matter. The first great difficulty with which we have to contend is that of securing such pipes, traps and connections as will prevent any escape of the air of the pipes. This is a far more difficult matter than is generally supposed. A want of uniform thickness in pipes, minute seams, some slight imperfection in joining, the settling of parts of the building, the effects of rust, or the incursions of rats, and the risk which every boss mechanic runs in the unfitness or carelessness of his workman, are all to be taken into consideration. We know that this has led one famous and trusty plumber to say that he believes it impossible to make any house-pipe absolutely air-tight in the house in the ordinary methods of plumbing. The security rather should be that the pipes are made as nearly impervious as possible, are so located as to allow full inspection, and then so aired, flushed and kept as to have no harmful gas in them. The Durham system, as it is called, puts up the house sewer-pipe system entirely independent of the building that contains it, and so seeks to secure safety. It can at least be claimed that great gains in safety of construction have been made, so that inside arrangements, properly located and trapped, are not hazardous.

The use of iron pipes, or of lead, in certain easily-reached connections, the trap under each wash-bowl or other inside convenience, the extension of the soil-pipe through the roof and there open, some opening in this main line where it is to leave the house, are generally accepted. Some would have a trap just beyond this opening, to act as a cut-off from the sewer or cesspool into which the pipe ends, while a few think this unnecessary in well-kept sewers. Some would have the outside opening extended by a pipe to the roof, while others think that this does not secure so good a circulation. But these minor questions do not unsettle the general conclusions as to what constitutes a good system of house sewer-pipes.

There are various laws as to the flow of air, water and sewage through pipes, the effect of shape, change of caliber, of fall of direction, the weight of material, &c., which are not lost sight of by the physicist and the sanitary engineer, however little they may be considered by the ordinary workman. But there never was a time when

science and arts and trades were so promptly handmaids of each other. So, progress is being made both by those who have head-craft and hand-craft. The one great evil is that there is so much lack in the numbers of skilled workmen and that the mechanic who knows how to do the work must so often depend for its execution on such unskilled assistants.

Now that so many and various forms of heating apparatus are used, some regard needs to be had to the effect of these upon the health of the household. These pipes, by their length or situation, not unfrequently cause imperfect combustion, and so many coal gases enter the house. Often rust causes holes in the pipes, and so there is poor draught and leakage. Sometimes a house in being heated is made to abound in draughts by the relations of the various heated pipes or surfaces to windows and other natural or artificial openings for the entrance of air. Here, again, there is need that important mechanical principles be understood and that all of the details of work be in the hands of skillful mechanics. Observation leads us to believe that the principles of all house-pipes are becoming better understood each year. So it is likely that this division of house construction will be improving, and all the more so because defects have of late been so fully specified.

LIGHTING-GAS IN ITS RELATIONS TO HEALTH.

In the last report of this Board we were able to furnish a valuable article as to illuminating-gas. While it must long remain as the chief source of light by night in cities, and as its use is so common in houses, it is well to be apprised of all risks. These are not simply those that arise from its profuse escape by reason of negligence in turning it off.

At a meeting of the London Medical Officers of Health in April last, Prof. Corfield read an article on "Outbreaks of Sore Throats Caused by Slight Escapes of Coal-Gas."

We are too apt to attribute anything deleterious in the air of houses to sewer-gas. While so often a source of danger, it is not the only pollution of house-air. Prof. Corfield gave many cases that had happened in his own experience, where relaxed and ulcerated sore throats had occurred in persons sleeping in rooms in which there were defective gas-burners or pipes, but living in houses of which the sanitary condition was otherwise perfect. That the slight escapes of gas were the cause of the sore throats, was proved by the fact that the

persons attacked became quite well on the defects in the gas-burners or pipes being remedied, and that no other cases occurred. Mr. W. Blyth referred to cases within his knowledge where headache was attributable to the same cause, and also to the course of water-mains as one of the sources which conveyed it from some adjacent leakage outside of the building. Our own attention has also been drawn to this source of air deterioration. Mr. Rogers Field said that he had found so many cases where offensive smells attributed to defective sewerage were owing to escapes of gas, that it was his practice to have gas-pipes tested where there had been reconstruction of the sewer system of the house. He found the only effectual method of testing the gas-pipes and fittings was to attach a pressure gauge, and then pump air into the pipes. If the gauge stood, then the pipes were sound; if it fell, there was a leakage, which had to be found out and remedied. He gave, among others, a case from an article by Prof. Pettenkofer, on "Poisoning by Lighting-Gas," in which a priest became ill, and was visited by a person who detected an odor of gas, and insisted upon his removal. When this was effected the person who remained in the adjoining room became similarly sick. The explanation of this was that the first patient always kept his room very warm, so that it drew the gas in, whereas on his removal the fire was let out and the windows opened, and then the gas was drawn into the adjacent room. A fracture of the gas-main in the street was discovered, and the cause of all the trouble was removed. Cases like these, and facts stated in our former report as to defects of gas-fixtures and gas-burners, and as to imperfect combustion, should lead all householders to be watchful against these slight leakages, which in time are quite sure to affect the health of those of the family that spend most of the time in the house.

TREES IN THEIR INFLUENCE UPON HEALTH.

In our efforts to combine the beauties of nature with the adornments of art we sometimes lose sight of the indications for health. In the choice of a building site we naturally take into consideration the atmosphere of the locality and all that goes to make up its climate. Attention has recently been directed to our power of modifying the climate of a locality not only in a general way but to that modification we may bring about in the house we dwell in and even in the particular room we occupy. While we can avail ourselves of trees

for shade, yet there are multitudes of homes seattered all over the State whose healthfulness there is reason to fear is diminished by the great number or too near proximity of trees. This arises in a great measure from the fact that in order to be of quicker service they are when planted placed too near, and then when growth makes them nearly to touch each other the owner dislikes to cut any of them down. Mr. Charles Roberts, a Fellow of the Royal Chirurgical Society, has recently presented this subject forcibly to the attention of sanitarians. We quote from his valuable article as follows:

"Trees of all kinds exercise a cooling and moistening influence on the atmosphere and soil in which they grow. The extent of these conditions depends on the number of trees and whether they stand alone, in belts, or in forests; on their size, whether tall trees with branchless stems or thickets of underwood; on their species, whether deciduous or evergreen; and on the season of the year. The cooling of the air and soil is due to the evaporation of water by the leaves, which is chiefly drawn from the subsoil—not the surface—by the roots, and to the exclusion of the sun's rays from the ground, trees themselves being little susceptible of receiving and radiating heat. The moisture of the atmosphere and ground about trees is due to the collection by the leaves and branches of a considerable portion of the rainfall, the condensation of aqueous vapor by the leaves, and the obstruction offered by the foliage to evaporation from the ground beneath the trees. The experiments of M. Fautrat show that the leafage of leaf-bearing trees intercepts one-third, and that of pine trees the half of the rainfall, which is afterwards returned to the atmosphere by evaporation. On the other hand, these same leaves and branches restrain the evaporation of the water which reaches the ground, and that evaporation is nearly four times less under a mass of foliage in a forest, and two and one-third times under a mass of pines than in the open. Moreover, trees prevent the circulation of the air by lateral wind currents and produce stagnation. Hence, as Mr. E. J. Symons has truly observed, 'a lovely spot embowered in trees and embraced by hills is usually characterized by a damp, misty, cold and stagnant atmosphere,' a condition of climate which is obviously unfavorable to good health and especially favorable to the development of consumption and rheumatism, our two most prevalent diseases.

"Now, if we examine the surroundings of many of our suburban villas and country houses of the better sort, we shall find them embowered in trees, and subject to all the insanitary climatic conditions just mentioned. The custom almost everywhere prevails of blocking out of view other houses, roads, &c., by belts of trees, often planted on raised mounds of earth, and surrounded by high close walls or

palings, from a foolish ambition of seeming to live 'quite in the country.' This is a most unwise proceeding from a sanitary point of view, and should be protested against as strongly by medical men as defective drainage and bad water-supply. Many houses stand under the very drip and shadow of trees, and 'the grounds' of others are inclosed by dense belts of trees and shrubs, which convert them into veritable reservoirs of damp, stagnant air, often loaded with the effluvia of decaying leaves and other garden refuse, a condition of atmosphere very injurious to health, and answerable for much of the neuralgias of a malarious kind, of which we have heard so much lately. A very slight belt of trees suffices to obstruct the lateral circulation of the air, and if the sun be also excluded the natural upward currents are also prevented. As far back as 1695 Lancisi recognized the influence of slight belts of trees in preventing the spread of malaria in Rome, and the cold, damp, stagnant air of spaces inclosed by trees is easily demonstrated by the wet and dry bulb thermometer, or even by the ordinary sensations of the body. A dry garden, on gravel, of three acres in extent in Surrey, surrounded by trees, is generally three or four degrees colder than the open common beyond the trees; and a large pond in a pine wood twenty miles from London afforded skating for ninety consecutive days in the winter of 1885–6, while during the greater part of the time the lakes in the London parks were free from ice.

"The following hints for planting and removing trees may be useful to those persons who have given little attention to the subject. A tree should not stand so near a house that, if it were to fall, it would fall on the house; or in other words, the root should be as far from the house as the height of the tree. Belts of trees may be planted on the north and east aspects of houses, but on the east side the trees should not be so near, nor so high, as to keep the morning sun from the bedroom windows in the shorter days of the year. On the south and west aspects of houses isolated trees only should be permitted, so that there may be free access of the sunshine and the west winds to the house and grounds. High walls and palings on these aspects are also objectionable, and should be replaced by fences, or, better still, open palings, especially about houses which are occupied during the fall of the leaf, and in the winter. Trees for planting near houses should be chosen in the following order: Conifers, birch, acacia, beech, oak, elm, lime and poplar. Pine trees are the best of all trees for this purpose, as they collect the greatest amount of rainfall and permit the freest evaporation from the ground, while their branchless stems offer the least resistance to the lateral circulation of the air. Acacias, oaks and birches are late to burst into leaf, and therefore allow the ground to be warmed by the sun's rays in the early spring. The elm, lime and chestnut are the least desirable kinds of trees to plant near houses, although they are the most common. They come into leaf early and cast their leaves early,

so that they exclude the spring sun and do not afford much shade in the hot autumn months, when it is most required.

"Trees are often useful guides to the selection of residences. Numerous trees with rich foliage and a rank undergrowth of ferns or moss indicate a damp, stagnant atmosphere; while abundance of flowers and fruit imply a dry, sunny climate. Children will be healthiest where most flowers grow, and old people will live longest where our common fruits ripen best, as these conditions of vegetation indicate a climate which is least favorable to bronchitis and rheumatism. Pines and their companions, the birches, indicate a dry, rocky, sandy or gravel soil; beeches, a dryish, chalky or gravel soil; elms and limes, a rich and somewhat damp soil; oaks and ashes, a heavy clay soil; and poplars and willows, a low, damp or marshy soil. Many of these trees are found growing together, and it is only when one species predominates in number and vigor that it is truly characteristic of the soil and that portion of the atmosphere in connection with it."

We desire to impress these views upon the attention of those of our citizens who have country or villa homes. Personal experience of these localities, and some facts as to consumption, rheumatism, diphtheria, and as to a general want of tone of system in those who have much indoor life in houses not exposed to wind, sunlight and the free movement of air, have led us to believe that there is much disease and much lowering of health from this cause. As valuable as trees and shade are, air and sunshine are still more valuable. Whatever keeps the ground upon which our houses are built in a damp condition, or provides a foliage so dense as to increase the dampness, is to be regarded as a hazard to health unless it is only temporary. With these cautions, it will not be found difficult so to combine the adornment of trees and shrubbery as not to exclude currents of air, and not dampen the ground by continuous shade.

IF SOME COMMUNICABLE DISEASES DEPEND UPON MICROBES, SHOULD WE BE LESS PARTICULAR AS TO LOCALITIES?

We desire here for the sake of argument to grant that many diseases are caused by the presence of microbes or minute forms of vegetative life as derived from the air or through the agency of food or water. It now becomes important to deal with a conclusion which some might claim to be based upon the admission, viz., that filth or local

conditions have nothing to do with the *origin* of communicable diseases, and so the removal of filth is only of secondary importance.

As to this statement we desire in the start to make the clear proposition that the presence of (germs) or microbes in disease does not at all prove that filth or local conditions have nothing to do with the *origin* of communicable diseases, for two reasons—first, because the history of most of the diseases claimed to be microphytic or microbic, so far as we can trace it, shows their origin to have been amid the most pronounced and intolerable filth conditions; second, the chief occurrence, propagation or extension of such diseases is where filth conditions exist.

As to the first, cholera is the best-known example. We are able to assert with great positiveness when and where it began to be. We know of no one who avers for it any other origin than amid the most pronounced conditions of accumulated filth amid the great encampment pilgrimages on the Ganges. Typhus fever and its branch, abdominal typhus or typhoid, have a similar history. Ship fever, jail fever, and tenement-house fever are descriptive enough of places of origin or prevalence. Diphtheria first appears as a distinct disease in 1855, and in the English reports was directly traced to Paris, Bologne, &c., and to the "inscrutable *cabinet* where the light of French refinement never comes; there the throat is assailed by the poisonous distillations that engender disease."

Because a disease that has once occurred afterwards obtains epidemic prevalence, so that the most of the first cases that occur of it in any place are derived therefrom, does not show that the original disease did not originate from insanitary conditions; does not show but that it may still have, exceptionally, such an origin, and does not show that even yet its *prevalence* or extent of outbreak and fatality is not chiefly dependent on such insanitary conditions. In the recent address of Dr. Thorne, of London, on the "Progress of Preventive Medicine During the Victorian Era," he says of typhoid fever that the operation of the infection was traced to channels always operating through the agency of filth, and that working on this line England since 1869 has steadily reduced its death-rate therefrom to 1.7 instead of 3.9 per 10,000. He states scarlet fever, diphtheria, phthisis and cholera as similarly controlled. In advocating the prevention of filth and of all insanitary conditions we have to say that we have never yet heard of the physician or sanitarian who has ever sought to create in

the minds of the public the belief that when dirt or filth are removed *all* causes of disease are gone. Who does not know that a perfectly healthy person may catch the small-pox, scarlet fever, or diphtheria? It is not asserted that *all* causes or *all* cases of any communicable disease can be prevented by the removal of insanitary conditions, but it is asserted that amid sanitary conditions far less cases are likely to occur; that single cases which have been caught are not so likely to be malignant, and that the disease is almost certain not to spread into an epidemic. It is for this reason that the leading sanitarians and physicians of the world (while recognizing that a disease may be caught by a healthy person, and so insisting upon isolation) have nevertheless never uttered a word that could be construed into an apology for dirt, filth or insanitary conditions as if they were secondary considerations in our battling against epidemics. On the other hand, they have accepted the dictum of William Farr, who says, "This is a primary rule: place the population in the sanitary conditions found by experience to be most favorable to health. Without this preliminary, all the other measures are futile. Every advance of sanitary art and practical administration has enforced this rule and illustrated its importance."

At the great International Congress of Hygiene just held at Vienna, the discussion on cholera was participated in by many of the most eminent men of Europe. At its conclusion by Professor Max Pettenkofer, of Munich, and Dr. Mosso, of Turin, Shirley Murphy, of London, drew attention to the fact that after various divergent views, "on one point all were agreed, the necessity of enforcing sanitary reform in the towns exposed to infection. This was recognized on all sides as the most effective precaution."

Whatever hypothesis may be indulged in as to "germs" or microbes, the relation of soil, overcrowding and filth to the prevalence, spread and fatality of communicable diseases is among the propositions accepted as a basis in practical sanitation. The facts in evidence as to our power to restrain and control these diseases by means of pure air, light and clean ground and enforced cleanliness, have led to this firm basis of sanitary administration as a mode of preventing epidemics. Minute forms of life perish amid pure air and sunshine and where organic matter in states of unnatural decomposition cannot be found. Sanitation does not merely mean the removal of filth. It means, sometimes, the removal of persons from their surroundings.

It means, always, the securement of pure air, in which minute forms of diseased vegetable life perish. It means light. It means the removal of dampness and of foul particles and gases. It means just what the sanitary inspector means and does when he attempts to put a house or a locality in the best sanitary conditions.

Isolation and enforced cleanliness, with all these included, are the two parallel bars upon which sanitary art is to show its powers of progression. He who neglects the first is sure to have some cases in which disease will occur in healthy persons and amid sanitary surroundings. He who neglects the second will have more. Because isolation cannot always be absolutely perfect, because we are not sure as to all that constitutes the origin of all diseases, and because experience has shown the intimate relations of filth, foul air, foul water and foods, and foul persons and clothing, to the occurrence, the spread and the fatality of disease, we shall succeed in our practical efforts for saving life in proportion as we unite *the most perfect conditions of local sanitation* with all that is feasible in isolation.

THE PERIODS OF COMMUNICABLE DISEASES.

In the diagnosis and management of diseases, and especially in determining the periods of isolation, it becomes important for us to know as accurately as possible the periods natural to each disease. In the investigation, we have two embarrassing facts to contend with. The one is that there is considerable variation. Yet it is possible to ascertain some valuable facts as to the range of this variation.

The other is that so few have kept an accurate record of all the details of a sufficient number of cases from which to deduce a law. This latter deficiency is becoming less, since numerical methods and collective systems of investigation have been more fully adopted. In 1884, Francis Vacher, medical officer of Birkenhead, gathered the statistics and views of very many who in each of the diseases named had recorded the facts. His own careful observations are also given. Dr. Dukes, of Rugby, has also collated various facts. We have for comparison also ascertained the views of several other good authorities. There are no facts that lead us to conclude that the periods of these diseases in our own country differ from those recorded by English authorities. Yet it must be confessed that opinions founded on numerous recorded statistics are scarce. We believe the table as

given by Vacher the most valuable, and especially of aid if studied in its details. As to variola or modified small-pox, as the secondary fever is always less, we think that the period of cessation of pyrexia is generally shorter than stated. Whooping-cough is not included in the list. The best evidence we have found would place the length of period of prevalence at six weeks, and have the period of isolation end with the entire absence of cough. It is, however, so variable in the time of its lasting as to be difficult of classification. Measles in its period of continuance seems sometimes affected by the weather. Taking the tables herewith furnished as the best guide, we ask that physicians will carefully note future cases. In some cases as between measles and German measles the diagnosis is aided by the quickness of the rash after first symptoms and by the short risk of communicability. As to eruptive fevers we need some close studies as to whether these are mostly or only communicable during the eruption. In all these diseases, after symptoms and eruption have fully subsided, the needed period for isolation is much shortened by such thorough baths as include cropping of the hair and attention to the nails. Not only some diseases but some persons are more contagious than others.

The following is the table referred to:

VACHER'S TABLE.

DISEASES.	Time from inception to beginning of eruption.	Time from first precursory symptom to beginning of eruption.	Time from beginning of eruption to cessation of pyrexia.	Time from beginning of eruption till patient ceases to be infective.
Small-pox	13 days (range, 7 to 21 days.)	2 days (range, a few hours to 7 days.)	14 days	56 days.
Modified Small-pox	13 days (range, 7 to 21 days.)	2 days (range, a few hours to 7 days.)	14 days	35 days.
Chicken-pox	13 days (range, 4 to 17 days.)	2 days (range, a few hours to 3 days.)	5 days (range, 3 to 7 days.)	17 days.
Measles	14 days (range, 7 to 21 days.)	4 days (range, 1 day to 9 days.)	6 days	27 days.
German Measles	14 days (range, 10 to 20 days.)	1 day (range, *nil* to 3 days.)	7 days	14 days.
Scarlatina	4 days (range, a few hours to 14 days.)	1 day	7 days	49 days.
Diphtheria	5 days (range, 1 day to 14 days.)	2 days (range, a few hours to 4 days.)	14 days	28 days.
Idiopathic Erysipelas	5 days (range, 2 to 14 days.)	1 day	14 days	35 days.
Typhus Fever	19 days (range, a few hours to 28 days.)	7 days (range, 3 to 7 days.)	7 days (range, 7 to 14 days.)	21 days.
Typhoid Fever	21 days (range, 1 day to 28 days)	7 days (range, 7 to 12 days.)	21 days (range, 14 to 28 days.)	28 days.
Mumps	18 days (range, 8 to 25 days.)	4 days	7 days	21 days.

SMALL-POX AND VACCINATION.

At the time of the last report there were some threatening indications that we were likely to have small-pox more prevalent in the State than recently. Several cases did occur, but only in a single district in Atlantic county did it gain much headway. There were also several cases in one family at Colt's Neck, Monmouth county, for the care and guarding of which Dr. James E. Cooper deserves much credit.

The cases in Atlantic county well illustrated the need of well-equipped Boards in sparse country districts, ready to act as soon as any rumor of an outbreak reaches them. By the active attention of this Board and the wise co-operation of the people of the locality, extended spread was prevented.

A warning circular sent to all city Boards of the State led to some active and general vaccination and proved of much service. In our sixth report we set forth in detail all the facts in evidence as to the subject of vaccination. Each year new series of carefully-studied facts emphasize its importance. Some time since the Epidemiological Society of London appointed a committee to report on the evidence which the present state of our knowledge gives as to the conditions affecting the protection afforded by vaccination against death by small-pox of persons contracting the disease. They collected the facts as to about ten thousand cases of the disease. The *London Lancet* of June last refers to it thus:

"Speaking generally, these statistics fully substantiate the opinions previously held as to the protective value of vaccination, but when considered in detail they teach lessons which have not hitherto been fully understood. In previous papers on this subject it has been assumed that the appearances of vaccination marks are not altered as the result of time; the committee, however, have been led to adopt a different view, and the grounds upon which their opinion is based appear to be sufficient to warrant the conclusion at which they have arrived."

The report gives evidence not only that cicatrices differ much at first in their foveation or deeply-pitted appearance, but that they differ in the degree to which such foveation fades or disappears with the lapse of time. Also that the degree of protection bears significant

relation to the number, distinctness and permanency of these depressions. The writer goes on to add these important facts:

"The importance of foveation, and especially of permanent foveation, is emphasized; and certainly the kind of vaccination which produces scars of this character is that which should be aimed at.

"In discussing the effect of quantity of scars, the evidence collected by the committee shows the urgent necessity for the production of the larger number of vesicles, and it may be hoped that a perusal of the report will lead every vaccinator not to rest content with a smaller number of vesicles than that recommended by the Local Government Board.

"The period of life at which revaccination should be performed must necessarily depend upon the character of the primary scars; but, under any circumstances, the statistics show that even where vaccination has been well performed a greater interval than fifteen years should not be allowed to elapse between the primary and secondary operation. Indeed, we are reminded of the conclusion of the German Commission, that the duration of the protection afforded by vaccination is on the average ten years.

"The small-pox hospitals have supplied the committee with the most positive evidence as to the immunity from small-pox conferred by revaccination upon attendants on the sick. Of 734 persons thus employed, 79 had previously had small-pox, leaving 655, of whom 10 were not revaccinated; all but these ten persons escaped small-pox, and all these ten were attacked. This should entirely dispose of the oft-repeated but erroneous statement of anti-vaccinationists that small-pox attendants escape disease from the fact that they are recruited from those who have already passed through an attack of small-pox. It is, indeed, impossible to read the evidence adduced on this point without understanding that it is within the power of every person absolutely to protect himself from all attacks of this disease."

We again urge upon all not only the importance of the subject but upon physicians the importance of noting and being guided by the minor details which determine between partial or exhausted or complete protection. The following extract shows how much one risk has been overstated:

On the 23d of August, 1887, in reply to Mr. Picton, Mr. Ritchie on behalf of the Local Government Board, said that:

"The Board are aware of the cases of vaccino-syphilis which are referred to in Mr. Hutchinson's publication. Three out of the six cases referred to in the question as a 'long series' related to single cases, and the most recent of any of the occurrences related took place

between ten and eleven years ago. The Board have the authority of Mr. Hutchinson for saying that though he has been diligently on the look-out for similar cases during the ten years' interval, he has failed to meet with any. In his recent work, published this year, on the subject, Mr. Hutchinson says: 'There certainly cannot be any difficulty under ordinary circumstances in procuring vaccinifers which are absolutely free from risk.' Mr. Hutchinson's experience was in these respects entirely confirmatory of that of the Board, which is to the effect that although three-quarters of a million of children have been vaccinated annually for many years past, not a case of the communication of the disease in question by vaccination has come under their observation."

Since the introduction of bovine lymph even this need not occur.

CHOLERA QUARANTINES.

The ravages of cholera in Italy and at points along the Mediterranean, as well as in South America, and our close commercial relations with ports exposed, made it no surprise that some vessels have arrived bringing this disease to the quarantine station of the State of New York. Fortunately there has thus far been no extension of the disease. The importance of better-equipped and better-administered quarantines has been so emphasized by some defects which have been discovered that it is believed new and more thorough precautions will be taken. Our own relation to the chief stations is such that we are fearfully exposed to the evils of any inefficiency of service at these points.

Nor is it cholera alone against which we need to guard. Epidemics of measles, scarlet fever and small-pox are known to have their rise in the same way. The quarantine officer at Stapleton claims that he is helpless in guarding sufficiently against all these. The past year we had an instance of what might easily have been a serious exposure in the case of a vessel not properly detained at New York quarantine which sought entrance at Jersey City, Elizabeth and Perth Amboy. The experience at the latter place with ship fever is another illustration of our exposure. In case of threatening epidemic it is a question whether there should not be examination of all passengers and baggage landed at Jersey City, Hoboken or other of our ports. Indeed, would it not be wise to organize such a service as a preventive rather than wait for the necessity to occur? Besides, this State

has such railroad relations that it is perhaps more liable to invasion by transportable contagions than any other State. We respectfully suggest this matter as deserving the early attention of the Legislature. Any contagious disease finding a center and becoming epidemic in Hudson or Camden counties would be a great peril to the sanitary and financial interests of the State.

This Board has kept itself in close correspondence with officers of adjacent States and with local authorities.

REMOVAL OF GARBAGE, REFUSE, ETC.

It is only necessary to have thorough appliances and an orderly administrative system for our cities to insure the removal of all forms of garbage, refuse or decayable matter. While there comes to be a limit to the degree and economy by which such materials can be disposed of in water or on land or as raising the land in the outskirts of cities, there is practically no limit to its destruction by fire. Cremators or incinerators of recent and improved patterns are now in use in England and in some of our American cities, which assure the feasibility of this kind of disposal.

Many of our larger cities should turn their attention to these, as they so much facilitate in the disposal of those substances which cause foul air, bad water and a lowering of vital power as well as fatal disease. We have on hand the details as to these and are ready to give to Health officers full particulars.

DISINFECTING APPARATUS.

No considerable town should now be without some form of stove or furnace for dealing with clothing which may contain the contagion of disease. The most of them are simple in construction and moderate in expense. The Ransom was the form mostly used until recently, when various improvements have been made. The most of these are well described in the report of the Committee on Disinfectants, as found in the twelfth volume of the A. P. H. Association, 1886, pp. 198–228.

THE PASSAIC RIVER.

During the present year very active discussion has been renewed as to the Passaic river. In its upper portion great damage to

property and some injury to health have resulted from the overflow caused by obstruction, and especially by the dam at Little Falls. We have had occasion to meet several Boards of Health of the townships concerned, and to examine, both by inspection and careful testimony, the evidences of injury.

If any one thing is proven as to sanitary needs it is that drainage is conducive to health, and that such interference with the natural course of rivers, amid rich lands and large populations, is fraught with the most serious results to the vigor of the people. The facts as to this region have been from time to time set forth in the reports of the State Geologist, and from a sanitary standpoint are fully confirmed by our own observation. We trust that some method will be devised either by the courts or by legislative act for the relief of the people of this large and valuable section of the State. The continued pollution of the Passaic as affecting the water-supply of Newark and Jersey City and parts adjacent, has been closely pressed upon our attention. In a spirit of careful inquiry we have instructed one of the Committee of Chemists of this Board to make some special examinations of a chemical and biological character, while other members of the committee are inquiring into the significance of facts and opinions as heretofore presented. A portion of the report of the committee will be found in this report.

We trust that these and others of our growing cities will have the foresight to command, for the great necessities of the future, the wonderful storage opportunities still within reach, and not leave themselves to be placed in dependency upon more active and far-sighted corporations. If the people are listless as to their interests and opportunities such combinations come to be the necessary substitutes.

THE LEGAL ASPECTS OF THE POLLUTION OF STREAMS.

BY E. S. ATWATER, COUNSELOR-AT-LAW, ELIZABETH, N. J.

The subject of pollution of streams involves questions of practical experience as well as law. Streams of water have been found to be a very convenient means of disposing of refuse and filth. In sparsely-settled countries, this process is one from which little harm is likely to result. As, however, population increases and cities and towns become more numerous and extensive, if this course is still pursued the volume of foreign substances is vastly increased and the pollution of the streams is the result. While the water of the streams is needed for other and more important purposes, yet it is rendered unfit for such purposes, and the greater the need the less fit is the water for use.

To what extent rivers should be used for the purpose of carrying off sewage, is a question of the highest practical importance. We all know that they are availed of for this purpose to a large extent in this State, it being the simplest solution of the sewer question to let them empty into a water-course wherever possible. It would be outside of the scope of this paper to enter into a scientific discussion of the best methods of disposing of sewage. At the same time it is obvious to remark that if a simple and comparatively inexpensive method shall be found of eliminating the solid from the liquid elements of sewage, a long step will have been taken in removing the difficulties of dealing with the question of pollution of streams. Another fruitful source of the pollution of streams is the discharge of the refuse from manufactories, especially those using dyes and chemicals mixed with a considerable quantity of water. There are a large number of factories which find streams a very convenient means of disposing of such discharge, which varies in its pernicious influence according to the size of the factory and the nature of the materials used. Even the rivulets and brooks are sometimes so polluted that

they become unfit for use for cattle. My attention has been called to the fact that such a case is now before the State Board of Health. Sometimes it is discovered that far up near the source of a stream there is a foul place which drains into it.

The germs of typhoid fever and other diseases have been carried from such sources into unsuspecting communities, and their origin has only been discovered when sickness and death have led to an examination to find out the cause. This subject is not without suggestiveness when we consider the streams as the abodé of fish. It is specially important, however, with reference to furnishing water-supply for man and beast. A distinction is made in the books between the primary and secondary uses of the water of streams. The first refers to the water coming in its natural purity so as to be fit for ordinary domestic purposes, and the second refers to cases where streams have been given over to other uses, such as manufacturing or other purposes, which tend to make the water more or less unfit for domestic use.

It may well be questioned whether the same rules should apply to all streams. In regard to navigable streams, particularly as they approach tide-water, it would seem to be impossible to keep them altogether free from pollution. A stream may be so situated with reference to cities located upon its banks and to factories in close proximity, that any attempt to keep it free from some degree of pollution would be unavailing, especially when it is used for purposes of navigation.

It may well be questioned whether discrimination should not be used in reference to the enacting or application of laws in regard to the pollution of streams, so that streams which have been for a considerable period given over to these secondary uses should be left for such uses, while rules and regulations relating to other streams necessary to the water-supply of cities, towns and villages should be rigidly enforced.

The subject of the pollution of streams has given rise to much litigation, particularly in England where the population is dense and towns are more numerous in proportion to the area than here, and of course the demand for water is greater and the respective rights of parties bordering on streams, owing to their proximity, are likely to clash.

The law on this subject has been stated in our courts:

"Every owner of land through which a stream of water flows is entitled to the use and enjoyment of the water and to have the same flow in its natural and accustomed course, without obstruction, diversion or corruption. The right extends to the quality as well as the quantity of the water. If, therefore, an adjoining proprietor corrupts the water, an action upon the case lies for the injury." Holsman *v.* Boiling Spring Co., 1 McCarter 342.

"No one has the right to pollute or corrupt the waters of a creek, or, if they are already partially polluted, to render them more so. All whose lands border on a stream have the right to have its waters come to them pure and unpolluted." Attorney-General *v.* Steward, 5 C. E. Green 415.

From these statements it will be seen that in the eye of the law, the pollution of a stream of water is a nuisance from which the owner of property along its banks may be protected both by action for the damages suffered and by injunction to prevent the continuance of the nuisance.

As an illustration of how far the courts in England have gone in the direction of protecting parties in their rights in this regard the case of Goldsmid *v.* Tunbridge Wells Improvement Co., L. R., 1 Ch. App. 349, may be cited. In this case the plaintiff was tenant for life of an estate in which was a lake or pond used for watering cattle and in the winter for the supply of ice for domestic purposes. The lake was fed by a brook which ran through the village of Tunbridge Wells. The defendants were commissioners under an act for lighting, cleaning and improving the town of Tunbridge Wells, which gave full powers to drain the town, to make sewers and to turn any drain or sewer into any common ditch or water-course. The sewage of the town was discharged into the brook, and had been so discharged for several years, but the town had been constantly growing, and thus the amount of sewage had been constantly increasing, so that at the time when the action was brought, the water in the plaintiff's lake, which up to within a short period had been fit for domestic uses of all kinds, had become unfit even for the purpose of watering cattle or furnishing ice for domestic use. The court held that the discharge of the sewage of the town into the brook was a violation of the plaintiff's right, and a nuisance, and the defendants were restrained from continuing it.

As between the upper and lower owners of the banks of a stream, the right to foul the water may be acquired by its continuance for

twenty years; in other words, by prescription. But this gives no right to increase the pollution. And as against the public no such right can be acquired. In a case in which an action was brought against the defendant for maintaining a dam whereby the water of a stream was set back upon the plaintiff's premises in such manner as to become stagnant, whereby the atmosphere was impregnated with unwholesome vapors which caused sickness, the court said: "There is no such thing as a prescriptive right or any other right to maintain a public nuisance. Admitting that the defendant's dam has been erected and maintained more than twenty years, and that during the whole of that period it has rendered the country unhealthy, such length of time can be no defense to a proceeding on the part of the public to abate it, or an action by an individual for the special damage which he may have sustained from it." Mills *v.* Hall, 9 Wend. (N. Y.) 315, cited in Wood on Nuisances 315.

From these citations it appears that the common law recognizes and enforces the right to have streams of water flow in their natural purity and that it is especially jealous of the rights of the public and is ready to exercise its powers for the abatement of a public nuisance, no matter how long the same may have existed.

The subject of the pollution of streams has received some attention from the Legislature of this State. In the year 1876 an act was passed, entitled "An act to prevent the willful pollution of the waters of any of the creeks, ponds or brooks of the State," to which a supplement was passed in the year 1880. The main features of these acts are that if any person shall throw or cause, or permit to be thrown, any carcass, offal or offensive matter into any reservoir or any creek, pond or brook, the waters of which supply any reservoir for public distribution, or shall connect any water-closet with any sewer, whereby the contents thereof may be conveyed into any such creek, pond or brook, or shall cause or permit any such carcass, offal or offensive matter to be deposited so that the washing or waste therefrom may be conveyed to any creek, pond, brook or reservoir, such person shall be deemed guilty of a misdemeanor and be liable to a fine of $1,000 and imprisonment for two years. The second section of the law requires the prompt burial of any such carcass, offal or other offensive matter at a distance of not less than two hundred feet from such stream or brook under the same penalties as before.

In the year 1884 an act was passed to prevent the discharge or

escape of sludge acid into and upon the waters of this State. By this act it is made unlawful for any person or persons, corporation or corporations to permit the discharge or escape, directly or indirectly, of such refuse or residuum resulting from the refining of petroleum, as is commonly called "sludge acid," into or upon any river, stream, water-course, lake, pond or other body of water, or any tidal waters within or bordering upon this State. Any violation of the act is to be deemed a public nuisance and punishable as such. All who have had any experience of the unwholesome character of this acid will agree that the law cannot be too vigorously enforced.

In 1882 a law was passed making it a misdemeanor to pollute, corrupt or render impure the ice in front of the lands of persons having ice-houses upon the waters of this State.

A law of 1885 gives power to Boards of Health of cities to regulate and control the sale of ice therein and to prevent the procurement of ice from any pond, creek or river within the limits of any such city.

The statutes above referred to are, of course, right and proper, and should be enforced. It will hardly be claimed, however, that they afford a complete and adequate protection against the pollution of streams. The protection of the sources of water-supply to meet the wants of the increasing population of this State requires something more than mere penal statutes, however carefully devised. In other words, the necessity of maintaining the purity of the water-supply is so great that *preventive* as well as punitive measures are required, for it is manifestly better, if possible, to prevent foul substances from being thrown into the water than to punish some person after the pollution has taken place.

That there is, within the borders of this State, an ample water-supply for the needs of the people for the present and future, if properly conserved and protected, is a fact which will be admitted without debate. Important questions here arise as to what control, if any, the State shall exercise over these waters, whether it shall in some manner and by some constituted authority maintain a supervision of these waters in the interests of the public health, in the exercise of the police power, or whether it shall, in the exercise of the right of eminent domain, take possession of these waters in the interest of the general public and furnish supplies to communities requiring the same. Of course the exercise of the right of eminent domain implies

compensation to private owners, and any such system would involve the payment by the communities benefited. Still further, whether the State should delegate the right to one or more companies or corporations to take possession of these sources of water-supply upon compensating parties whose rights may be affected, with power to build storage reservoirs and aqueducts for the purpose of supplying the communities requiring water. It is not within the scope of this paper to discuss the feasibility or expediency of either of these latter plans. It would seem, however, that if it were finally determined that certain streams and lakes should be set apart for purposes of water-supply, and if they were taken possession of for that purpose, that little difficulty would be found in framing proper regulations by which their purity might be protected. The proper control and distribution of these waters are of vast importance to the welfare and prosperity of the State.

In this State, commissioners were appointed under an act entitled "An act to provide for the appointment of commissioners to determine upon plans for the storage of any of the waters of this State for the purpose of furnishing to cities and towns a joint water-supply," passed in 1882. The object of this act is indicated by its title. The commissioners can only act when applied to by the aldermen or other governing power of a city or town, and their powers are only to make recommendations. When their work in any case has so far proceeded as to be accepted by the cities or towns concerned, an act of the Legislature is required to carry it into effect. The commissioners have presented valuable reports to the Legislature. This act, so far as I am aware, is the only one on our statute-books in any way relating to a general supervision of water-supply. The work of these commissioners is simply advisory.

In this connection it may not be amiss to refer to the question of the title to streams and lakes, &c. This subject has been much considered in the courts throughout the United States and elsewhere, and the same rule does not obtain in all the States. In this State it has been held that "all waters are divided into public waters and private waters. In the former the proprietorship is in the sovereign, *i. e.* the State; in the latter in the individual proprietor. The title of the sovereign being in trust for the use and benefit of the public—the use which includes the right of fishing and of navigation—is common. The title of the individual being personal, is exclusive—

subject only to a servitude to the public for navigation, if the waters are navigable in fact. The test by which to determine whether waters are public or private is the ebb and flow of the tide. Waters in which the tide ebbs and flows, so far only as the sea flows and reflows are public waters, and those in which there is no ebb and flow of tide are private waters." Cobb *v.* Davenport, 3 Vroom 378. In brief, the law appears to be in this State that the riparian owner on the banks of a fresh-water stream owns to the center of the stream. In the case of Society for Establishing Useful Manufactures *v.* Morris Canal Co., Sax. 187, the Chancellor said: "They [the Society] are the riparian proprietors, and upon plain and acknowledged common-law principles they are entitled to the use of the stream. They have in it a property growing out of the ownership of the soil, which is oft-times of more value than the soil itself, and at all times is sacredly regarded by the law. This being the case, they have a right to enjoy it without diminution or alteration." "The right is not confined to the use of so much of the water as may be necessary for their present purposes. They have appropriated to themselves the use of the stream. They have a right to take out the whole of it for the purpose of their manufactories, provided it is again, after being used, restored to the bed of the river for the benefit of those below; and provided, also, that no one having prior rights is thereby injured. Such I take to be the common-law rights of this society, independent of any additional privileges that may be secured to them by their charter." This doctrine was re-affirmed in 1864 in a case reported in 2 C. E. Green. It will be noticed that it is not an absolute property in the water that is referred to here. It is the right to *use* the entire flow of the stream, providing that the water is returned to the stream.

It has seemed to me proper, in order to an understanding of the subject with which we have to deal, to enter somewhat into the question of the title to these fresh-water streams as the same has been set forth in our courts. But it by no means follows that the State has no control over them. And while the riparian owner has the right to the use of these waters, it is, after all, *only* the use. Indeed it has been said that, properly speaking, there is no property in water, only in its use. Washburn on Real Estate, Vol. II., pp. 63 and 65.

Where protection of these waters is necessary for the public health the State may, in the exercise of its police power, maintain a supervision over them to prevent their pollution. The doctrine of the

right of the State to exercise jurisdiction and control over this class of streams is laid down in the books. See Wood's Law of Nuisances, § 472. See, also, Carfield *v.* Coryell, 4 Wash. U. S. C. C. Reports 371.

In Massachusetts such supervisory powers are now exercised. In the year 1886 "An act to protect the purity of inland waters" was passed in that State. The State Board of Health was the body entrusted with the carrying out of the provisions of the act. The principal duties of the Board under the act are, in brief:

1. To have the general care and oversight of inland waters.

2. To have the custody of maps, plans, &c., made for this purpose.

3. To recommend legislation and suitable plans for systems of main sewers.

4. To cause examination of the waters of ponds and streams to be made.

5. To recommend measures to prevent the pollution of waters.

6. To conduct experiments on the purification of drainage.

7. To conduct experiments on the disposal of manufacturing refuse.

8. To consult with and advise the authorities of cities and towns, or with others, in reference to water-supply and drainage.

9. To consult with and advise manufacturers with reference to the disposal of manufacturing refuse.

10. To bring to the notice of the Attorney-General all omissions to comply with existing laws.

From the foregoing summary it will be seen that the Massachusetts law confers on the State Board of Health similar duties to those entrusted to the commissioners in this State, in relation to communities seeking a water-supply, and also duties in relation to the pollution of streams and to devising means to prevent such pollution and to obviate its cause. It may be questioned whether it is wise to follow altogether in the line of the Massachusetts law, but the statute is valuable as showing the method of dealing with this subject in another State, where the number of large inland towns, especially the manufacturing places, situate on streams of water, have forced into consideration the necessity of preserving the purity of the waters of these streams, and the necessity of the disposition of sewage and the refuse from factories. Doubtless much may be learned from the experience of that Board in this matter, as the same will be presented in their annual reports from year to year. That similar duties, however, should be entrusted to the State Board of Health in this

State, or some other competent authority, would seem to be a wise policy. In case of streams actually used for furnishing water-supply, and reservoirs also, it would seem that some sort of a patrol or frequent inspection should be maintained, so that where anything is being done to pollute a stream it may be discovered and prevented. The preventive effect of such patrol or inspection would be very great, and has already been exercised in a few instances.

AIR, WATER AND FOOD.

BY EZRA M. HUNT, M.D.

As air, water and food are the materials from which the human structure is sustained, no question can be more important than how we are to obtain these in such purity and so prepared as to be adapted to human needs. It is for this reason that each of these so largely occupies the attention of the sanitarian. Science and art are constantly busy in throwing light upon this question, and experiment and experience are putting to practical test the claimed deductions of science. No one who studies these subjects but that knows that there is progress all along the line. Our greatest difficulty is in securing the practice of all that is known. Even for this, administration is doing much.

As to the air, the first studies have relation to those laws of Nature which determine the climate. The studies of climatology are being pursued with great zeal, and are revealing many of the influences which determine the climate of a given locality. The advantage of this is that we can foretell and so avoid exposure, or that we can to some degree modify, as by choice of site, trees, sunshine, &c. When unable to do this we can make choice of the climate suited to us with more intelligence. The local modification of one's own atmosphere is no longer one of the mere possibilities. It is being utilized in the fitting up of houses in the modes of introducing air and in the general adjustment of surroundings.

So soon as Priestly made his discovery as to the normal constitution of air we had a standard of comparison. By one step after another we have advanced to a knowledge of the various modifications of air and the various causes of impurity. For a long period we were wont to think that carbonic acid, more correctly called carbon dioxide, was the chief source of impurity. But it was found that a much larger proportion of this existed in some air artificially made, which was breathed with comparative ease. So, attention came to be directed to the fact that the new methods of determining the organic matter

in air are being employed. (See Marion Talbot, A.M., on the "Determination of Organic Matter in Air."—*Technology Quarterly*, Vol. 1, No. 1.) Organic matter contained in the breath was of much more moment than the carbonic acid in itself considered. In fact, the amount of this has been considered recently as mostly important as an index of the organic matter. But now there is still further progress. The character of the organic matter, both as to quantity and quality, is found to have many variations. So, not only is one odor more significant than another, but where there is no perceptible odor there is variety of contents.

"The progress made in hygienic researches by the application of bacteriological methods has been nowhere better exemplified than in the investigation of air. Dr. Percy Frankland has pursued the subject in this country with much profit, and there has lately appeared in the Philosophical Transactions a paper by Professor Carnelley, Mr. Haldane and Dr. Anderson, of Dundee, which should be carefully studied by sanitarians. The investigations here described consisted in the analysis of the air of dwellings as regards carbonic acid, organic matter and micro-organisms, the carbonic acid being estimated by the method of Pettenkofer, the organic matter by that of Carnelley and Mackie, and the micro-organisms by that of Hesse. As regards dwellings, their inquiry involved a comparison between houses of from one to four rooms and upwards, and the composition of the air within these tenements with that without. As an example we may cite from one of the numerous tables the following figures, which represent the average quantities in one-roomed houses, relatively to those in houses of four rooms and upwards (which are taken as 1): cubic space per person, 0.11; carbonic acid, 2.0; organic matter, 4.4; micro-organisms, 6.7 (bacteria, 6.9; moulds, 3.0). The carbonic acid, organic matter and micro-organisms all diminish in quantity as the cubic space per person increases from 100 to about 1,000 cubic feet; but beyond this capacity there is a slight increase in these impurities, which is attributed to inadequate ventilation of the larger rooms. An instructive comparison is made of mortality statistics with the composition of the air of these dwellings—the death-rate increasing in proportion to the rise in impurity of the air, there being a very rapid increase in the death-rate among young children, and the mean age at death being very greatly lessened. The death-rate from phthisis is lower in those living in one and two-roomed houses than in those living in three rooms, but this anomaly is readily explained when the early mortality of the former from other diseases is considered. Thus the death-rate per 10,000 from (1) diarrhœa, acute bronchitis, broncho-pneumonia and meningitis is—for dwellers in four rooms and upwards 19.6, for those in three rooms 27.6, for those in two rooms 39.7, and

those in one room 59.8; from (2) phthisis the rates are respectively 13.0, 27.6, 24.4 and 14.6. The inquiry also showed the effect of impure air in promoting pulmonary disease; and as regards infectious disease the mortality from measles and whooping-cough seemed distinctly connected with the class of house, whilst, contrary to expectation, no such relation held for diphtheria. The memoir also enters fully into the subject of the composition of the air of schools, of mills and factories, and of the Royal Infirmary, Dundee, and proves that the determination of carbonic acid alone is not a sufficient indication of the purity of a sample of air. We can only mention the very exhaustive study of the conditions which influence the excess of organic matter and micro-organisms, and the proofs of the superiority of mechanical over natural ventilation, but may state that the authors give as 'standards of purity' the occurrence of 10 vols. of carbonic acid per 10,000 in the air of dwelling-rooms, and of 13 vols. per 10,000 in that of schools—or an excess over outside air of 6 vols. in the one case, and 9 vols. in the other. These limits should not be exceeded. Nor should the excess of organic matter within the house over that of the air outside be equivalent to more than 2 vols. oxygen per 1,000,000; and the excess of micro-organisms should not be more than 20 per litre. Of these three classes of impurities, the carbonic acid (in the amounts mostly present) is the least deleterious to health, being compensated for by increased frequency of respirations; but the 'organic matter' probably has a great effect in lessening the health and predisposing to disease; whilst micro-organisms, apart from specific infection, may be responsible for broncho-pneumonia, so frequent and fatal a complication of the prevalent bronchial catarrh and other affections. The paper concludes with suggestions of remedies—especially the adoption of mechanical ventilation and improved ventilation by means of open grated windows in landings in block tenements; other recommendations, such as the avoidance of keeping lamps burning at night, the adoption of cleanliness, attention to frequent renewal of air as of more importance than the size of the rooms, and the construction of windows so that they can be freely opened at intervals to allow a good current of air to be sent through the rooms, are such as will commend themselves to everyone."

Besides, we are coming to take cognizance of various admixtures of the gases of decomposition as well as the presence of particles from the animal, vegetable and mineral world, some being in a state of vitality and other parts in a state of more or less decomposition. We shall therefore be able more and more not only to speak of impure air in general, but to characterize the impurities and prevent or neutralize them. This is no doubt the reason why some air not more excessive than some other, in carbonic di-oxide, is found more injurious. The

further we get in this line of inquiry the more the evidence accumulates that our schools, our factories, our assembly-rooms and our homes must be studied in relation to the air they contain. Nothing so insidiously and so surely saps vitality as the constant dependence upon improper air. Especially in childhood does it lower vitality and diminish the formative vigor of life, while in adults it embarrasses vital force and shortens the effective work-life of artisans.

Prof. Leeds, at the instance of the Board of Education of Hoboken, has made some examinations of school-room air which have shown such results as have led to a bettering of conditions as shown by subsequent tests. More reliance will have to be placed on mechanical methods. These have been greatly simplified and cheapened. Some of these consist of fans and similar appliances, while others supply air by an air compressor worked by a gas engine, so that fresh air is turned on or off as is gas or water.

It is a great satisfaction that we are not only having dissertations on the evils of foul air but are getting at facts and at practical modes of relief. But it is ever to be remembered that nothing can compensate for a continuous enforced in-door life and that a part of life should be spent out-of-doors, and especially that children must have the benefit of vigorous exercise in the open air. The welfare of the people of the State so much depends upon some knowledge as to the air conditions of health, that under the heads of "Impure Air and Death Rates," "Carbon Dioxide, Organic Matter and Micro-Organisms in Their Relations to Impure Air," and "School-Room Ventilation," we present the following notes and reflections:

IMPURE AIR AND DEATH-RATES.

It has long been accepted as settled that the breathing of impure air is unfriendly to health and life. Yet no question is more frequently discussed than what constitutes unsafe impurity and what are the most serious degradations of pure air. Until recently our chief mode of comparison was to obtain a knowledge of the quantity of carbonic acid (carbon dioxide) by the Pettenkofer method, and accept this as the statement of other impurities. Parkes, and afterward Dr. de Chaumont, had made this a standard. Dr. de Chaumont, putting the quantity in ordinary air at four volumes per 10,000, gives six (6) volumes in 10,000 as the maximum amount where proper ventilation is secured. When it reaches eight in 10,000 he calls it

no longer good, and decidedly bad when it reaches ten volumes in 10,000.

So soon as biological studies showed the relations of organic matter and of different varieties of it in different degrees of unstable change, and so soon as the quantity and quality of microphytes or micro-organisms came to have some determinate significance, it was evident that there must be direct study of these factors in forming judgment as to the purity and impurity of air. There has been considerable investigation of these subjects, but we know of none so recent and valuable as the conjoint work of Messrs. Carnelly and Haldane, of University College, Dundee, and that of Dr. Anderson, the medical officer of health of this same city of over 150,000 inhabitants. Their article and the details of their experiments were presented by Sir Henry Roscoe to the Philosophical Transactions of the Royal Society of London, in the summer of 1886. The object was to examine the air of various classes of houses in order to compare the carbon dioxide, the organic matter and the micro-organisms with one another and with the death-rates in these houses. This led to a study of what are ranked among laborers' houses as one-room, two-room and three-room houses; to a comparison of school-rooms as to cubic space and the effects of different methods of ventilation, as also some investigation into the sources of the organic matter and the micro-organisms found. We are at first wisely reminded that the tests which are the best for determining organic matter do not decide its varied kinds, although some of it is far more harmful than other varieties. The number of micro-organisms, also, does not settle questions of quality. For these the Hesse method was used. Without presenting all details, we wish to bring to notice some of the most painstaking and conclusive results.

Several experiments showed that the average of carbonic acid and organic matter was uniformly higher in town than in suburban or country air, the difference being relatively much greater in organic matter than in carbonic acid. The quantity of organic matter, at least in town air, varied within much greater limits than that of carbonic acid.

The influence of day and night, and of open and closed spaces, was also tested. In open places the carbonic acid during the night was less than during the day, as also the organic matter. Of both of these there was more in close than in open places. Micro-organisms as well as organic matter were less at night than during the day. So

far as organic matter is concerned this is in part accounted for by the greater stillness of night, so that the organic particles are not set afloat.

In examination of air in houses, one and two and three-roomed houses were examined, and also four-roomed and larger houses, as standards for comparison. Putting these last at one, the two-roomed houses had 1.5 carbonic acid, 1.6 organic matter, and 5.1 micro-organisms, while the one-roomed houses had 2.0 carbonic acid, 4.4 organic matter and 6.7 micro-organisms. The carbonic aid, organic matter and micro-organisms diminished in quantity as the cubic space per person increased from 100 to 1,000 cubic feet. *Beyond* 1,000 cubic feet the micro-organisms showed a slight but distinct increase. The authors suggest the following explanation for the anomaly:

A large bed-room of say 3,000 cubic feet has usually about the same means of ventilation as one of only 1,000 cubic feet. So the air will be changed less frequently in the larger than in the smaller room, and, in the former, portions of the air at least may be more stagnant. If this be true for bed-rooms without special means of ventilation, 1,000 cubic feet of sleeping-space per person is the best. Our authors, by the diligent assistance of the officer of health, were able to study closely the relation of impure air to death-rates.

The extent of the examinations and comparisons is shown by the fact that it embraced a sufficient number of houses to include 3,119 deaths. The conclusions arrived at from the tables have been already given.

Some similar comparisons were made by Kötösi in Buda-Pesth. These showed that of all that died above five years of age the mean age in the best class of houses was 44.2 years, in the middle class 42.2 and in the worst 39.9. The mean age of those who died in the worst-class houses under five years of age was one year and among the rich 1.3 years.

The tables of our authors show the death-rate by phthisis highest in *three-roomed houses*, which they account for by the fact that pulmonary consumption is seldom in the form of tuberculur disease in young life, and in one and two-roomed houses much fewer live to the consumptive age, so as to diminish the material and so make the actual death-rate lower.

As we pass from four-roomed to one-room houses there is much increase in acute bronchitis and broncho-pneumonia, as also in mortality from measles and whooping-cough, both of which depend so

much for their mortality upon pulmonary inflammations. This corresponds with the statistics of Kötösi. (Annales d'Hygiene Publique, Vol. XIV., 1885, p. 571.)

There seems some difficulty in accounting for the fact that one-room houses do not show any marked increase of cases of scarlet fever and diphtheria.

Our authors suggest the hypothesis that scarlet fever has no secondary broncho-pneumonia, and so the tissue is not attacked by micro-organisms, as where mucus favors it. It is also claimed that the same is true as to diphtheria except where the specific poison excites the inflammation. We think this apparent anomaly must still be *sub judice*. It does not seem to be peculiar to Dundee, as Kötösi notes the same as to his statistics of Buda-Pesth. It does, however, appear that Dundee had an epidemic of scarlet fever the previous year, and the death-rate was then at least a third greater in one and two-roomed houses.

Another fact that appears is one as to longevity, viz., that there is a much larger proportion of old people living in the better than in the worst class of houses. The paper is a most valuable addition to our experimental knowledge of the effect of foul air on health and life.

CARBON DI-OXIDE, ORGANIC MATTER AND MICRO-ORGANISMS IN THEIR RELATIONS TO IMPURE AIR.

Absolutely pure air, like absolutely pure water, is very scarce. But not less valuable is a knowledge of what it is, if only we determine what and how much are those impurities which render it undesirable for breathing purposes. As to some of these we are able to determine very readily. Thus, sulphurous acid and many other gases soon advertise its unfitness for respiratory purposes. So, certain stenches are so noxious as soon to declare themselves as foreign to the constituency of good air. Dust and perceptible organic or mineral particles of various kinds do not need much consideration to show that they were not meant for the lungs.

So far as close and practical inquiry is concerned we have chiefly to do with three classes of admixtures. These are carbonic acid, organic matter and micro-organisms. Of these the first is most easily considered, because it is a simple and definite chemical gas, whose properties can be accurately defined. We know it to be unfavorable to sustained life. But we also know that in the usual

amount of four volumes in 10,000, as it occurs in the atmospheric ocean, it does no possible harm. Indeed, we know that if we could have only the pure nitrogen and oxygen in their air proportions and increase the amount of carbon dioxide up to fifteen volumes per 10,000 we would, in the great open, have no appreciable result. Therefore the determination of the absolute quantity of it in air is not *alone* the criterion of purity. As, however, found in ordinary dwelling-houses and rooms in the summer, in the absence of fires and lights, it is an important study, since in these cases it presents the results of human respiration, in which the amount of it is found to bear relation to a process in which oxygen is also being removed and this non-vitalizing gas substituted in its place, together with organic matter. It is found to bear a pretty definite proportion to the quantity of organic matters in an unstable and decomposable state which are given off by the lungs. When it is kept in mind that expired air contains nearly 440 volumes of carbonic acid per 10,000, and that it is rare to find in close, populated houses more than forty volumes of carbonic acid per 10,000, we see how full of adjustment are the resources of nature. So uniform are the relations and the processes of life and of the diffusion of the respiratory products, that its determination is of great general value as a guide. Those who accept it as such also know how to make allowance for disturbing incidents.

"Organic matter" is a far more general term as applied to certain contents of air, and its presence is oftener fraught with serious consequences. But so much depends upon the kind or quality of organic matter and upon its state of stability or change that these, too, must be fully known. Even our tests mislead us somewhat, for sulphurous acid, if present, and some other compounds, respond to the test and cannot always be recognized as disturbing the result of the test in its specific meaning. So its determination as to rooms and to the usual conditions of what may be called "nostalgia" or home-sickness, in a special sense, is valuable because if produced by human beings we know its deleterious and unstable character and can generally take into consideration dust, mineral matters, combustion, &c., as that may add thereto. No doubt the oxidizable, organic matter expelled, varies in different persons according to health, activity, cleanliness, &c., but here again the average of quantity and quality is quite uniform for classes of dwellers taken together.

Where the organic matter is largely dust, or where the air is

stagnant, there will be settling and perhaps continuous oxidation, so that the carbon dioxide will be increased and the organic matter diminished. Where there is active exercise there is increase both of organic matter and of carbon dioxide. Although differences in cleanliness do not seem to affect the amount of organic matter, this is probably because the results of uncleanliness only become apparent by exercise and finds its record during or after it.

Next is our study of *micro-organisms*. While the number has probably some relation to the purity of air, so long as we have not settled the lines between harmless and pathogenic varieties we can only speak of them tentatively and without full knowledge of their significance. Our authors go so far as to say that as regards the influence of the micro-organisms of air, it seems probable that for persons in perfect health the great majority of them are harmless. This opinion is not based on the idea that they have no significance as indicating the purity of air, but on the idea that unless there is much bronchial mucus, the epithelium or cilia of the respiratory passages entangles them and sweeps them out so that they do not reach the air cells.

One of the most interesting points elicited is, that micro-organisms are not given off in the ordinary respiration of healthy persons, or at least not to any appreciable extent. On the contrary, those present in the air appear to stick to the mucous membrane of the nose and larynx and trachea, &c., so that the air passages practically act as filters. Thus, if all are fairly well, the microphytes are those in the room or those from the skin and garments of the persons.

The accompanying record in one-room and two-roomed houses shows at a glance how these micro-organisms are symptomatic, although we cannot fully ascertain as yet all that they signify. The only comparison made as to different forms of micro-organisms was between bacteria and moulds. Moulds come mostly from the outside air. When the air in a room becomes vitiated the bacteria increase largely, while the number of moulds is affected to a relatively much less extent, if at all. The observations and experiments were in all one hundred and seventy-nine.

In summing up the evidence thus obtained as to the vitiation of air from carbon dioxide, organic matter and microphytes, the authors propose the following standards: The upper limit for dwelling-houses (especially in sleeping-rooms) of carbon dioxide is ten volumes per 10,000. Yet when we read that in Portsmouth convict prison

Wilson found all the prisoners in the larger cells healthy when constantly in them with 7.2 volumes of carbon di-oxide, but those out all day and in all night pale and anæmic at 10.4 volumes of carbon di-oxide, ten seems too near the margin for safety.

The amount of organic matter should not be in excess over outside air more than would require 2.0 volumes of oxygen per 1,000,000, and the micro-organisms should not exceed twenty per litre. Although odor is in general some indication as to the organic matter and its character, yet as smell is much influenced by temperature and humidity there may be foul air without odor. As applied to rooms, however, under usual circumstances it does indicate much. How familiar to most physicians is the odor of badly-kept, stuffy houses?

Experiments seemed to show that the accumulations of organic matter which quite uniformly take place in stagnant air, prove far more serious than a pretty high amount of carbonic acid, for which a little more rapid respiration will, for a time, compensate.

The authors believe that frequently in children the stagnant and rapidly-changing organic matters cause convulsions, sudden prostration and collapse. As we are just now having great expectations from the enumeration or census of microphytes it will surprise some to hear the opinion expressed "that for persons in perfect health the great majority of them are harmless."

Among the valuable points suggested as to the purification of air independent of mechanical methods are the following:

Cleanliness of person and dwelling and open air spaces.

Where the rooms are not so proportioned to occupants as to give full air space, frequent change of the air of the room.

Ventilation by diffusion diminishes carbonic dioxide far more than it does organic matter or micro-organisms.

Windows should be made to open above and below, and both sashes should be used as much as possible.

The practice of having a lamp burning all night in bed-rooms in small houses is greatly to be deprecated, as the heat, the organic matter and the carbonic acid aid in the reduction and deterioration of the air.

SCHOOL-ROOM VENTILATION.

Much that relates to the ventilation of school-rooms is embraced in what has been said of ventilation in general, as it is found respectively in houses of various sizes. We here only desire to add a few

more points that are more special as to those assembled in close occupancy for shorter periods.

The number of schools examined was 68 different schools and class-rooms, and many of them at different times and under various conditions of ventilation. Of these, 42 were ventilated in the ordinary way, by fire-places, windows, &c. (natural ventilation), and 26 were ventilated by fans, which blew air (plenum, mechanical ventilation) into the rooms. The examinations began December 16th, 1885, and closed April 28th, 1886.

In the rooms mechanically ventilated, air was blown by fans over hot pipes and thence into the several rooms by broad, shallow, upright shafts, opening at a *height of five feet* from the floor. The vitiated air is taken off by shafts, which *open two feet* from the floor and carry the air up into a chamber in the roof. Thence it is discharged through louvre-boarded ventilators, fitted inside with valves, which prevent any possibility of back-draughts.

As a rule, there is an *outlet* shaft at each end of the room, and one or more *inlet* shafts on each side. The air on entering the room thus passes wholly or partially toward the ceiling, and must thence pass downwards to find an exit by the outlet shafts, which open two feet from the floor. The current is intended to sweep the whole room, in this way, while the broad and shallow inlet shafts, through which a large volume of air enters at a low velocity, insure a good distribution of air with as little draught as possible. While by this arrangement there is slight opportunity for organic matters to settle on the floor, yet this is no evil if the rooms are properly swept and cleansed every day. The temperature of the rooms was never over 65°, and the average 55.6°.

The experiments showed that the carbonic acid was three-fifths, the organic matter one-seventh, and the micro-organisms less than one-ninth of what they were in schools ventilated by ordinary methods, while a higher temperature was also maintained where the mechanical ventilation was used. Professors Brazier and Niver, who made determinations of carbonic acid only for four schools in Aberdeen, two being ventilated mechanically, found similar results.

It was found that those attending the average board or public schools for six hours a day had often, before improvements, been subjected to a school-room atmosphere containing, on an average, nearly 19 volumes of carbonic acid per 10,000, and a very large proportion of organic matter, and no less than 155 micro-organisms per litre.

The cubic space per person in schools, unlike that in houses, showed no definite connection with the purity of the air, except as regards the number of micro-organisms. In mechanically-ventilated schools these diminished with an increase of cubic space. Other facts seem to show that cubic space beyond narrow limits is of little account, *if there is not proper adjustment* of ventilation so as to promote constant currents of air.

No comparisons were made between different systems of mechanical ventilation representing both the plenum and exhaust methods. But these carefully-made experiments led our authors to express the view:

1. That most common schools are badly ventilated and that the symptoms ascribed to overpressure are probably largely due to the defective ventilation of schools, and that a sufficiently pure air in schools (without draught) appears to be attainable only by mechanical ventilation. They give as reasons why they believe the plenum method to be better than the exhaust method that (*a*) draughts are more easily avoided, and (*b*) that the great objection to the suction method is that a partial vacuum tends to be produced, which would greatly accelerate the entry of sewer-gas into the room from any defective drains (or other sources of foul air), whereas the "blow-in" method has the positive advantage of producing the opposite effect. (*c*) A more uniform and higher temperature may be attained in winter, and the method is independent of the state of the weather.

A mode of finding carbon dioxide and "A New Method of Estimating the Proportion of Carbon Dioxide in Air," are given as follows by Dr. Cassidy in the Ontario Report of the Woodstock Convention, 1887:

"The estimation of the volume of carbon dioxide gas it contains is at present the only experimental method of judging of the condition of the air in inclosed areas, and therefore it is important, from a sanitary point of view, to possess an easy and rapid means of ascertaining the amount of this gas present in the atmosphere. Several plans have been proposed for this purpose, all of which are based on the milkiness produced by carbon dioxide in a colorless solution of lime or baryta, and therefore on a qualitative appearance, which is not directly connected with the amount of gas actually present. The new apparatus devised by Dr. R. Blockmann possesses the merit of giving quantitative results, and of being so simple in its action that no chemical knowledge is required in order to use it. It is also very cheap. The process is based on the employment of a sufficient volume of the air under trial to saturate by means of the carbon dioxide gas present

in it, a given amount of lime-water of a certain strength. In order to recognize the fact of this saturation a few drops of a solution of phenol-phthalein are added to the lime-water until it assumes a visibly red tint. The color remains as long as the liquid continues alkaline, but directly the caustic lime is all converted into the carbonate a very small excess of carbon dioxide is sufficient entirely to destroy all trace of the red tint.

"The apparatus consists of a glass bottle capable of holding 500 c. c. or half a litre, a hollow bent glass tube used in sucking the air out of the bottle, a solution of phenol-phthalein, and a solution of lime-water 1-10 the strength of the volumetric solution, or one in which 1 c. c. of lime-water is equal to one-tenth of a milligram of carbon dioxide.

"The mode of using it is as follows: The bottle is filled with the air to be tested by sucking out the air contained in it through the bent glass tube; ½ oz. of lime-water is poured into the bottle, together with three drops of the solution of phenol-phthalein, and the bottle is then corked and shaken for three or four minutes; if the liquid is still red the bottle is filled a second time with air, corked and shaken as before, and the process is repeated until the color in the liquid vanishes. If the color does not completely fade after any particular filling, but fades immediately on making another filling, we may take the one before the last as the correct reading. Thus, in testing the air at the Brock avenue school, I found that the red tint had nearly vanished at the second filling, and that it disappeared completely on filling the bottle the third time. The amount of carbon dioxide was therefore not more than for two fillings, and but little less, or in round numbers .806. If the color remains for four fillings the air is very good, if it remains for three it is good, if it disappears on the second filling it is on the borders of what sanitarians call bad air, if the color goes on the first filling the air is so impure as to render it wholly unfit to be breathed.

"A table has been prepared, showing the exact quantities of carbon dioxide gas present, in 1,000 volumes of air, as indicated by the results of each filling—from the first to the fourth. Thus—1 filling, 1.61 carbon dioxide per mille; 2 fillings, .806 carbon dioxide per mille; 3 fillings, .537 carbon dioxide per mille; 4 fillings, .400 at 60° Fahrenheit. A correction is not necessary for a temperature over or under 60°, as it would involve no greater difference than a factor in the third decimal place. By increasing the quantity of lime-water the presence of much larger volumes of the gas can be ascertained; thus, with 1 oz. of lime-water a discoloration at the first filling would imply the existence of 3.22 volumes per mille."

The report of Thomas H. McCann, as President of the Board of Education of Hoboken, gives the following tabulated results of examinations made of the schools of that city by Professor A. R. Leeds:

HOBOKEN SCHOOL AIR-TESTS.

Date.	School Number and Position of Room.	No. of Scholars.	Sex.	Average Age.	Floor Space, Square Feet.	Height of Ceiling.	Capacity in Cubic Feet
Jan. 18, '87, 11 A. M.	*Public School No. 1, Garden and 3d Sts*						
	11th Class Room	44	Boys	8	437	10 feet 7 inches.	4676
	10th Class Room	28	Girls	9–10	460	10 " 0 "	4600
	5th Class Room	30	Boys	10–11	446	11 " 0 "	4912
	5th Class Room	32	Girls	11–12	408	11 " 0 "	4428
	14th Class Room	38	Mixed	6	529	11 " 0 "	5819
	Outside air same time	.....	.....	.....	.....	.....	.....
Feb. 14, '87, 11 A. M.	*Public School No. 1.*						
	11th Class Room	47	Boys	8	437	10 feet 7 inches.	4676
	10th Class Room	27	Girls	9–10	460	10 " 0 "	4600
	5th Class Room	30	Boys	10–11	446	11 " 0 "	4912
	5th Class Room	33	Girls	11–12	408	11 " 0 "	4428
	14th Class Room	48	Mixed	6	529	11 " 0 "	5819
	Outside air same time	.....	.....	.....	.....	.....	.....
Feb. 16, '87, 11 A. M.	*Public School No. 2, Garden and 9th Sts.*						
	5th Grade Class Room, south wing, 2d floor, 2d room	33	Girls	11	443	11 feet 0 inches.	4873
	1st Grade Class Room, south wing, 3d floor, 1st room	31	Mixed	15	468	11 " 0 "	5148
	10th Grade Class Room, north wing, 1st floor, 1st room	41	Boys	5½	578	11 " 0 "	6358
	7th Grade Class Room, north wing, 1st floor, rear	48	Boys	9	313	11 " 0 "	3443
	5th Grade Class Room, 2d floor, 1st room	38	Boys	10	548	11 " 0 "	6020
	Outside air same time	.....	.....	.....	.....	.....	.....
Feb. 17, '87, 11:30 A. M.	*Public School No 3, Adam and 3d Sts.*						
	13th Class Room, south wing, 1st floor, rear	75	Boys	8	457	15 feet 0 inches.	6860
	11th Class Room, north wing, 1st floor, rear	40	Boys	8–9	320	10 " 0 "	3200
	2d Class Room, north wing, 2d floor, rear	25	Girls	11	382	14 " 0 "	5348
	6th Class Room, north wing, top floor	42	Boys	11	444	13 " 0 "	5772
	6th Class Room, north wing, top floor	36	Girls	11	394	14 " 0 "	5523
	Outside air same time	.....	.....	.....	.....	.....	.....
Jan. 25, '87, 11:20 A. M.	*Public School No. 4, Park Avenue.*						
	Class Room No. 2, south side top floor, middle room	28	Girls	14	400	12 feet 0 inches.	4800
11:45 A. M.	Class Room No. 8, northeast room, top floor, High School	33	Mixed	16	729	12 " 0 "	8748
	Class Room No. 5, north side 2d floor, middle room	42	Boys	12	400	15 " 0 "	6000
10:45 A. M.	Class Room No. 4, northeast side 1st floor	50	Boys	8	360	15 " 0 "	5400
10:40 A. M.	Class Room No. 7, southeast side 1st floor	58	Girls	12	460	15 " 0 "	6900

HOBOKEN SCHOOL AIR-TESTS.

Means of Ventilation.	Ventilation at Time Sample Taken.	Temperature, Fahr.	Barometer.	Volumes of CO per 10,000.	Cubic Feet of Space per Scholar.	Remarks.
2 windows	1 open 6 inches at top	60°	......	21.50	106	
6 "	1 " 2 " "	70°	......	18.60	161	
3 "	2 " 4 " "	6[illegible]°	......	14.[illegible]0	164	
4 "	Partly open	65°	....	15.40	138	
3 "	1 open 6 inches at top	60°	......	18.60	153	
......	......	30°	......	4.18	......	
2 windows	1 open 6 inches at top	61°	782	28.94	99	
6 "	All closed	65°	782	19.18	170	
4 "	All open 6 inches at top	65°	782	18.44	164	
4 "	1 open 6 inches at top	68°	782	23.20	184	
3 "	1 open 6 in. and 1 12 in. at top	65°	782	14.57	135	
......	......	30°	782	4.20	......	South wind, slight; atmosphere clear.
4 windows	2 open 12 inches at top	75°	760	11.58	128	
3 windows Vent. over door	1 open 18 in., top and bottom Open	78°	760	12.70	166	
6 windows 2 ceiling vents	2 open 12 inches at top Act badly	75°	760	21.11	145	Air of room very close and disagreeable.
4 windows	3 open 3 feet at top	72°	760	15.20	72	
7 windows 2 ceiling vents	3 open 3 feet at top Act badly	76°	760	17.05	158	
......	......	55°	760	4.10	......	No wind; atmosphere hazy and dull.
2 windows	2 open 18 inches at top	78°	762	17.42	91	Air of room unpleasant.
4 small windows	2 " 6 " "	79°	762	19.54	80	Air of room very close and disagreeable.
3 windows 2 door ventilators	3 open 12 inches at top Closed	77°	762	12.34	214	
4 windows 3 vents. nr. ceiling	3 open 6 inches at top Open	77°	763	12.20	137	
4 windows	2 open 6 inches at top	77°	762	8.98	158	
......	......	48°	762	3.60	.....	S.W. wind; very fine; cloudless.
2 windows 2 ventilators	1 open 6 inches at top	75°	......	14.78	171	
5 windows 1 door ventilator	2 open 2 feet at top	72°	......	13.50	265	
2 windows 1 ventilator	2 open 3 feet at top	75°	......	10.00	160	
2 windows	2 open 4 feet at top	72°	......	9.50	108	Close.
4 "	Had all just been opened	64°	......	16.00	180	Not close.

HOBOKEN SCHOOL AIR-TESTS.

Date.	SCHOOL NUMBER AND POSITION OF ROOM.	No. of Scholars.	Sex.	Average Age.	Floor Space, Square Feet.	Height of Ceiling.	Capacity in Cubic Feet.
Feb. 15, '87, 11 A. M.	*Public School No. 4.*						
	Class Room No. 2	24	Girls	14	400	12 feet 0 inches.	4800
	Class Room No. 8	34	Mixed	16	729	12 " 0 "	8749
	Class Room No. 5	38	Boys	12	400	15 " 0 "	6000
	Class Room No. 4	48	Boys	7-8	360	15 " 0 "	5400
	Class Room No. 7	46	Girls	10½	460	15 " 0 "	6900
	Outside air same time	......	......	......	......	......	......
Feb. 21, '87, 11-11:15 A. M.	Annex No. 1, Garden and 2d streets	150	Mixed	6-7	1089	10 ft. 0 in. walls	11434
	Pupils on roll altogether	175	......	......	......	......	......
	Annex No. 3, 2d street near Clinton street	192	Mixed	6-7	1740	10 ft. 6 in. to apex of roof, 25 ft.	30885
	Pupils on roll	200	......	......	......	......	......
	Outside air same time	......	......	......	......	......	......
Feb. 24, '87, 11 A. M.	Another sample of air from 11th Class Room, School No. 1	47	Boys	8	437	10 feet 7 inches.	4676

HOBOKEN SCHOOL AIR-TESTS.

Means of Ventilation.	Ventilation at Time Sample Taken.	Temperature, Fahr.	Barometer.	Volumes of CO per 10,000.	Cubic Feet of Space per Scholar.	Remarks.
2 windows; 2 ventilators	1 open 6 inches at top	75°	767	15.41	200	Air close.
5 windows; 1 door ventilator	2 open 12 inches at top	80°	767	12.63	257	
2 windows	2 open 5 feet at top	78°	767	11.06	158	
2 "	2 " 4 " "	70°	767	7.014	113	
4 "	2 " 6 inches at top	70°	767	12.12	150	
......	......	45°	767	4.67	......	No wind; atmosphere close, hazy; wet, drizzling rain.
5 windows; 1 door	1 open 12 inches at top; Frequently open	72°	771	21.21	76	Air close and disagreeable.
......	......	......	......	......	65	
10 windows	3 open 6 inches at top	76°	771	26.11	161	Air very close and very unpleasant.
......	......	......	......	......	154	
......	......	41°	771	3.852	......	North wind, slight; clear; fine.
2 windows	2 open 6 inches at top	70°	775	18.26	99	Outside temperature 42°; fine.

The same report details what is known as the Smead-Dowd system of ventilation. The ventilation methods applied in some of the schools of Hoboken, and especially in the new school building, are well worthy of examination by all cities contemplating changes of former structures, or the erection of new buildings.

These and other facts point to the increased interest being taken in the sanitary condition of school-houses. There is no subject that more involves the health of the people and the welfare of the State.

WATER FOR DRINKING PURPOSES.

The question of the purity of our water-supplies must ever continue to be one of the first importance for the consideration of Health Boards, in their care of the public health. Water is the great purveyor or distributor of the nutrients of the system, as well as the conveyancer of much of the effete material which needs to be removed from the system. Water may contain a great deal of animal, vegetable or mineral matter foreign to its chemical composition, and yet make no appreciable evil impression upon the system. So much depends upon the state which this matter is in; upon the state of the health of the person drinking it and upon what, for the absence of any better term, we must call the resistance or unsusceptibility of some persons, either naturally or by acquirement and toleration, to the predisposing or exciting causes of disease. Because these varying conditions are difficult to define, and often difficult to recognize, we are forced, first of all, to try and place ourselves in a position of safety.

In doing this we appeal to certain axioms. The first of these is that the human system was never meant to receive into it materials in a decayable or putrescent state. While it is happily true that the juices of the stomach have some power to arrest decomposition, and that the system in general has power to overlook many deleterious influences, no one has yet been found to assert that we may go on indefinitely contaminating a water-supply in the confidence that the powers of the system, or the tendency to adjustment and toleration will so far prevail as to make the use of such water of no consequence. If we could not fall back on general principles or the reliability of primary or axiomatic beliefs, cases of specific disease, disturbances of the digestive apparatus and a general lowering of vigor or shortening of life, have given well-grounded evidence of serious results. Evidences have no need to be more complete than those adduced by Dr. Snow, as to the relation of the cholera districts of London in 1849 to water-supply; the numberless established relations of typhoid fever to water-pollution; the dependence of dysenteries, diarrhœas, &c., on impure water and the persuasion of close observers as to the effect of impure water upon general vigor and good health. A specimen of this kind of evidence may be found in Wilson's Hand-book of Hygiene, pp. 169–185.

There are two or three natural ways at which we arrive at the

evidence of an impure water-supply. One is, by knowing what is put into the water. As to this, the casual observer may jump too readily at conclusions. It is wonderful what amounts of decayable and putrescible matter may go into a stream, and yet, by solution, by dilution, by aëration and by lower animal and plant life, be so disposed of as to disappear. Yet, as the infusion of any great amount of such matter into potable water-supplies is in the direction of danger, we must be assured by some proper tests that such rectification has taken place. The test of this is now offered to us in three forms. We shall call them the *chemical* tests, the *biological* tests and the *experience* tests.

First of all, it is certain that the chemists give us some very important evidences as to the purity or impurities of water-supplies. In no direction have they been more studious. Such tests as the Permanganate test, the chlorine test, the ammonia or Wanklyn test, the Frankland or combustion test, and the Grandval & Lajoux, Nitrate's test, and scores of modifications or collateral aids, assure us that in this way we get indications as to the character of water-supplies. It is the weakness, still, of the chemical method that it does not inform us much as to the chemical relations of microphytes or minute forms of vegetative life which have so much to do with disease, and especially specific diseases, and that it is not able, accurately, to define differences that may yet exist in waters that have apparently the same chemical composition. There are cases in which, by a chemical standard, a water might be pronounced impure in which, in the absence of knowledge of possible modifying factors, we could not rely on the analysis alone. Yet, there are excesses of evil conditions that in themselves show a water so full of hazard to the population at large as to make the risk too great for general use.

More recently there has come to our aid what is known as the biological determination of water conditions. This is intended to reach such characteristics of water as relate to microphytes or micro-organisms, as these are found to have not only great relation to some diseases, but to the disposal made of organic matter in a mobile state or process of decay. Dr. R. Koch early applied his methods of bacterial test in this direction, and has been followed by a host of capable observers. It seeks to determine the nature and the relative abundance of micro-organisms in different samples of water, as also the conditions under which the colonies multiply or decrease. The papers

HOBOKEN SCHOOL AIR-TESTS.

Date.	School Number and Position of Room.	No. of Scholars.	Sex.	Average Age.	Floor Space, Square Feet.	Height of Ceiling.	Capacity in Cubic Feet.
Jan. 18, '87, 11 A. M.	*Public School No. 1, Garden and 3d Sts*						
	11th Class Room	44	Boys	8	437	10 feet 7 inches.	4676
	10th Class Room	28	Girls	9–10	460	10 " 0 "	4600
	5th Class Room	30	Boys	10–11	446	11 " 0 "	4912
	5th Class Room	32	Girls	11–12	403	11 " 0 "	4428
	14th Class Room	38	Mixed	6	529	11 " 0 "	5819
	Outside air same time	.....	.....	.....	.....	.....	.....
Feb. 14, '87, 11 A. M.	*Public School No. 1.*						
	11th Class Room	47	Boys	8	437	10 feet 7 inches.	4676
	10th Class Room	27	Girls	9–10	460	10 " 0 "	4600
	5th Class Room	30	Boys	10–11	446	11 " 0 "	4912
	5th Class Room	33	Girls	11–12	403	11 " 0 "	4428
	14th Class Room	43	Mixed	6	529	11 " 0 "	5819
	Outside air same time	.....	.....	.....	.....	.....	.....
Feb. 16, '87, 11 A. M.	*Public School No. 2, Garden and 9th Sts.*						
	5th Grade Class Room, south wing, 2d floor, 2d room	33	Girls	11	443	11 feet 0 inches.	4873
	1st Grade Class Room, south wing, 3d floor, 1st room	31	Mixed	15	468	11 " 0 "	5148
	10th Grade Class Room, north wing, 1st floor, 1st room	41	Boys	5½	578	11 " 0 "	6358
	7th Grade Class Room, north wing, 1st floor, rear	48	Boys	9	813	11 " 0 "	8148
	5th Grade Class Room, 2d floor, 1st room	38	Boys	10	518	11 " 0 "	6029
	Outside air same time	.....	.....	.....	.....	.....	.....
Feb. 17, '87, 11:30 A. M.	*Public School No 3, Adam and 3d Sts.*						
	13th Class Room, south wing, 1st floor, rear	75	Boys	8	457	15 feet 0 inches.	6860
	11th Class Room, north wing, 1st floor, rear	40	Boys	8–9	320	10 " 0 "	3200
	2d Class Room, north wing, 2d floor, rear	25	Girls	11	382	14 " 0 "	5348
	6th Class Room, north wing, top floor	42	Boys	11	444	13 " 0 "	5772
	6th Class Room, north wing, top floor	36	Girls	11	394	14 " 0 "	5528
	Outside air same time	.....	.....	.....	.....	.....	.....
Jan. 25, '87, 11:20 A. M.	*Public School No. 4, Park Avenue.*						
	Class Room No. 2, south side top floor, middle room	28	Girls	14	400	12 feet 0 inches.	4800
11:45 A. M.	Class Room No. 8, northeast room, top floor, High School	33	Mixed	16	729	12 " 0 "	8749
	Class Room No. 5, north side 2d floor, middle room	42	Boys	12	400	15 " 0 "	6000
10:45 A. M.	Class Room No. 4, northeast side 1st floor	50	Boys	8	360	15 " 0 "	5400
10:40 A. M.	Class Room No. 7, southeast side 1st floor	53	Girls	12	460	15 " 0 "	6900

take all precaution. In any doubtful case it is better to have the water boiled and then cooled for drinking.

The next test to be noted is that from experience. It is one of the most important in making up the evidence in the case, and yet, as usually named or conducted, the most vagrant and unreliable of all. It too often has no visible means of support. We can perhaps illustrate it no better than by stating what a physician or other practical man would wish to do if he had all the time and facilities for such an investigation. He would first call to his aid all the preliminary aid that experiment or the experience of the laboratory could give, and know the actual condition of the water used each day. He would perhaps at first select 100 children and give them no other drink for several days, and give it when the stomach was empty, so that it would be more rapidly absorbed. He would choose those who had not become innured to this particular water, and would record the amount taken and what seemed to him to be the results. In the absence of ability to be thus accurate, he would, at least as to a certain number, keep a record each day of the amount of water drank, and would have any apparent effect noted. He would divide them into classes, as to age or health or locality, so that he might be aided by comparisons, and would also for a time have similar classes on water known to be very pure. He would thus note effects at different seasons and different times of the year, and would continue his observations for long periods. He would be on the look-out for specific diseases, such as are believed to result from special micro-organisms in water, and trace any possible connections. Thus he would be gathering *classified experience*, the only kind that is coming to be considered of very much value as amounting to evidence. Even medicine meant originally knowledge by measurement, and that is what the best knowledge of the physician means.

We do not desire to wholly ignore the more general observation of the physician. There is some general and acquired experience such as the local weather prophet has as to the coming day or night, or such as the physicians gather as to the signs and symptoms of certain diseases. But physicians need *themselves* to know that such knowledge has a more substantial basis than *opinions* as to the *causes* of ill-health in cases in which many factors may be operative. It is easier to get some useful experience out of the symptoms of disease so as to aid in treatment than it is to select and define causes. One has

expressed it thus: "The analysis of waters which have proved to be decidely *injurious* shows that in general the impurities are numerous, and, on the other hand, not one but several diseases may be either directly produced or indirectly influenced by them. And this difficulty of apportioning to special impurities their special effects is frequently increased by the presence of other causes of disease." Where the death-rate, instead of being but fifteen in 1,000, or, as Chadwick contends, it should not be over ten in 1,000, is between twenty and thirty in 1,000, it is always in order to estimate the facts as to drinking-water. But physicians, like others, unless they have *collected the facts* which make up a real experience as to the part had in causation by various operating influences, had better at once say to the public that they are not expert witnesses here to the same degree as they are in the diagnosis and treatment of disease. In some special outbreak they may be able to separate and identify causes, but cannot be expected in every case of diarrhœa or malaise to estimate the influence of every co-operating cause. It is for this reason and because they are expected to do this, and do not always decline when they are interviewed for opinions, that there is so little of definite agreement of views. Yet no class of men are better satisfied that it is not healthy to drink water shown to be laden with organic matter in a putrescible condition. This is so proven by the principle and law of life and so confirmed by cases of classified experience that illustrate it, that it is not essential to identify the relative effect of the portion being conveyed by any one vehicle. If present, it is its law to produce its effects. By reason of modifying influences there will be in individual exceptions and in varied seasons great variation in results, such as will puzzle those who are impressed by exceptions more than by a prevalent law. But the fact will remain and make its record sometimes in much sickness, sometimes in a sudden outbreak, sometimes and mostly in a general abridgment of vitality or of the length of years. Such is the uniform record of crowded cities as compared with the country. As to water-supply, London is not the only city that has recorded the relation of a diminished death-rate to the introduction of improved water-supply.

OUR STATE NEEDS AS TO WATER-SUPPLY.

In one sense we have no needs. The water-supply of the State is unsurpassed. Its water-sheds almost seem to have been arranged for the supply of great populations. In the cretaceous formation an ocean of underground reservoirs seems to await the up-drawing of the adjacent cities. But there is the sad fact that a large portion of our population seems to have forgotten or sold its birthright. Within an area of about thirty miles about 600,000, or more than one-half of our people reside. The most of them, if they drink water at all, drink that which is unwholesome. Yet the upper basin of the Passaic is near at hand, as well as other water-sheds easy of access. There is no reason why Hudson, Essex and Union counties should not have the best and cheapest water-supply on the continent. The reports of the State Geologist, those of the State Board of Health and the special report of the Commissioners of State Water-Supply have given year after year the abundant facts. The topographical maps of the State illustrate the facilities. In the southern part of the State, Camden, which has similar needs, can also be supplied. The time has come when on a business basis all ancient claims of water-power, when interfering with health, should subside before the greater claims of water for the people. There are substitutes for these *powers*, but no substitutes for water as a drink for man and beast. We can only urge upon the State, as one of the greatest demands for health and as an exercise of the plainest political economy, the appropriation of these vast reservoirs to the use of the people.

FOODS.

While air and water have their nutritive and essential uses, we must look to our third division, that of foods, for the general sustenance of life. In our search for these we seek such articles as are found in the system, or such as the chemistry of digestion can convert into nourishment and force. As to many of them, we also need, by cookery, to present them in such form as will render them most available. It is not our design, in this connection, to trace the relations between the various foods and their adaptations to the human system. The subject has before been treated upon by the Secretary of this Board in the third (1880) report of the Bureau of Labor and Statistics, and in "The Principles of Hygiene."

We desire only at present to draw attention to what is feasible as to the securement of foods in a proper condition for sale. Our first attention is needed as to meats. These form so large a proportion of food-supply that they need to be guarded with care. This is best accomplished where there are public abattoirs, under competent inspection, and when no butcher's meat is offered in the market that has not passed this inspection. Next to this is the value of market inspectors, who have oversight of meat, fish, poultry and all other food materials offered in markets. The inspector needs not only to have honesty and watchfulness, but to have expert knowledge. Even so brief an outline as that of Mr. Vacher, health officer of Birkenhead, near Liverpool, is of great service. Every city should have its market inspector, with power to reject all produce unfit for consumption. The guard against decayed or wilted fruits and stale vegetables is also very important for city populations. Such oversight is much easier made, practically available and efficient, than that sought as to adulterations.

The next important guard of foods is as to milk. It is true that milk is not apt to be offered in a stale state, but because of its so frequent dilution with water it is often less of a food than it appears to be. Even here, we are on the borders between what are called commercial frauds and those which endanger health. But, because it is so essential and constant a food and so often falsified, it may be singled out for special guard.

Where, as in the case of mustard, for instance, or spices, or even of oleomargarine, it never has been shown that there is any serious risk to health, we do not believe it to be an important function of a Health Board to deal with the matter. While fully appreciating the desirability of preventing commercial frauds, this is not the function of health laws. Even if such effort were thought desirable for Health Boards as a co-operation, it is, for many reasons, impracticable for a Health Board to engage in a service in which they are not likely to benefit the public health at all in proportion to the outlay. For them it would be the withdrawal of money from more important spheres of health administration. This Board, therefore, with its use of money for this purpose limited to one thousand dollars, has only sought to deal with such adulterations, or to make inquiry in such directions as would guard against substances which might be hazardous to health. To this end it made full inquiry into the evidence

of English authorities, and as to various examinations made in this country. It thus became more apparent how little, practically, the public health was involved in most of the falsifications. Just because they are commercial, the dealers sedulously seek to avoid injurious articles and intend to use those that are inert, or that are, in part, real substitutes. In order that we might more fully trace what might be happening in our own State, examinations were made of various products. The valuable record in the fifth and other reports, and the specimens in our rooms, confirmed the view that inert or similar substances are mostly used, and that the accomplished design is felt upon the pocket and not on the health. Nevertheless, as it is possible that in some cases health may be involved, we shall continue watchfulness and inquiry within proper limits. We are the more able to do this because the pursuit of adulterations as frauds is provided for in a separate service.

OUTLINES OF REPRESENTATIVE SEWER SYSTEMS

AS IN OPERATION IN NEW JERSEY, AS FURNISHED OR COMPILED FROM DESCRIPTIONS BY

J. J. Croes and F. S. Odell, Mem. Am. Soc. C. E., New York City.
Geo. P. Olcott, C.E., Orange, N. J.
C. P. Bassett, C.E., Newark, N. J.
Prof. Chas. McMillan, C.E., Princeton, N. J.

As no subject is more vital to the health of the citizens of the State than that of a right disposal of all waste products which tend to decomposition, we have thought it wise in the present report to pass in review some specimen systems of a few of the more available methods.

If the reader will refer to descriptions of methods contained in former reports by the Secretary and to some special papers contained in former reports, as indexed in this report, it will be found that every method has been reviewed and its salient features and adaptability pointed out.

As improvements are constantly occurring and as new methods are introduced we have for this report selected for prominence four methods devised and executed by engineers of repute and now in operation in this State. We might point to several in addition, but as the next year we hope to give outlines as to all the water-supply and sewerage works in the State, this outline will be found sufficient for the present. In it we have occasion to thank the engineers named, either for furnishing original contributions or for referring to such documents and descriptions as have enabled us to present a brief but sufficiently technical outline of construction and methods.

Leaving out of view for the present the old and valuable system of surface irrigation and the modification of supply so as to give intermittent filtration, we, by examples, pass in review these four systems as in actual operation.

THE DRAINAGE AND SEWERAGE OF THE LAWRENCEVILLE SCHOOL, MERCER COUNTY, N. J.

AS DEVISED BY J. J. CROES, C.E., AND CONSTRUCTED UNDER THE DIRECTION OF F. S. ODELL, C.E.

Where there is not sufficient land available, or where it is easy to pass a classified effluent into a stream, we sometimes have a modification of two or three methods.

Thus, Engineer J. J. Croes, of New York City, has placed an extended system in the High School at Lawrenceville, which avails itself in part of this sub-irrigation or absorption tile system, but also depends upon the discharge of sewage thus purified by passage through a small area of land, into an adjoining brook.

We are permitted to avail ourselves of the following description :

DRAINAGE.

"That portion of the grounds in which the buildings are located is generally dry and needed little subsoil drainage, but it was deemed advisable to lay subsoil drains near the buildings, and in three cases entirely around the foundation walls below the level of the cellar floors, so as to insure their being dry at all times. Subsoil drains were also laid along the drives and walks, and the entire play-ground was underdrained by parallel lines of subsoil drains laid thirty feet apart.

"These subsoil drains are of round agricultural tile, from one and one-quarter to two inches in diameter, and are laid on uniform grades about three feet below the surface, and have their outlet in the nearest road basin.

"To provide for the surface drainage of the drives and grounds, a complete system of drains was laid, following the general direction of the drives, with catch basins opening from the gutters at intervals of about three hundred feet. These drains are of salt-glazed stoneware pipe from six to eight inches in diameter, with joints of Portland cement-mortar. They are laid about three feet six inches below the surface, to true lines and grades, and have their outlet in the brook at the lower portion of the grounds.

"At the time the outfall system was designed it was thought that the large extent of lawn surface on very flat slopes, and the deduction of the roof area from the water-shed, would so materially diminish the discharge from the rainfall, that a capacity of carrying off 100 cubic feet per minute, or about an inch and a half of water on the road surfaces per hour, would be sufficient.

"The experience of the first six months of 1886 showed that this was not sufficient, as the road drains were overtaxed three times during that period, causing pools of water to be formed for over an hour in some depressions of grade, and also causing the water to flow out through a man-hole on the lower level near the engine-house, and flood the boiler-room floor.

"This was undoubtedly partly caused by two departures from the plans for constructing and operating the works.

"*First.* The side drainage of the road in front of the property was not completed according to the plans, and thus a large quantity of water flowed across the road and on the school grounds from an extended slope on the opposite side of the road.

"*Secondly.* The supply from the well having been plentiful, the steam engineer in charge of the boiler-house found it easier to draw all the water from that source than to open and shut the cocks which change the pump suction from the well to the rain-water reservoir, so that the latter was never used and all the roof. water was discharged into the road drains at their connection with the outfall pipe.

"But, even if due allowance is made for these irregularities, it is not unlikely that in the case of a heavy rainfall, when the ground on the campus is frozen, the capacity of the outfall would have been found to be too small. A direct connection has therefore been made between the junction of drains at the reservoir overflow-pipe and the pond, by a twelve-inch pipe, making the total capacity of discharge 450 cubic feet a minute. The highway drains opposite to the school property have also been attended to, and the road-water thus diverted from the grounds. So far (March, 1887) this has proved satisfactory in the heaviest rainfalls which have occurred since the pipe was laid, the rain-water reservoir having been used for the purpose for which it was intended, and the roof-water consequently retained in it."

SEWERAGE.

"The necessity of disposing of the sewage within a limited area of the grounds made it imperative that its volume be limited to a minimum, and therefore all surface or subsoil drainage was excluded from the sewers, and disposed of as previously related; then, to insure positive immunity from leaky joints, it was decided to use six-inch cast-iron pipe, with leaded joints, for the sewers.

"The pipes were 0.395-inch thick, and weighed twenty-five pounds to the foot. They were coated with coal-tar varnish, as were all the cast-iron pipe used on the grounds.

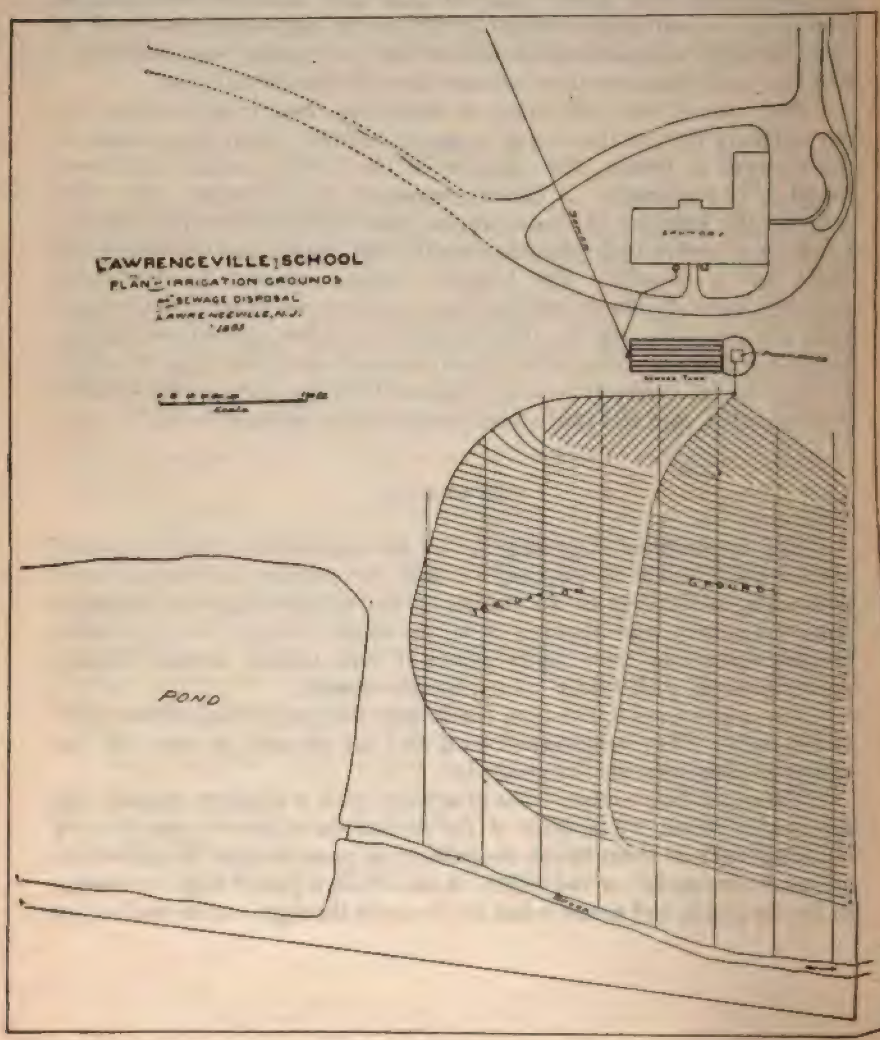
"There are two branch lines of sewers, with a flushing man-hole at the head of each. The lines of the sewers are selected to serve every building with as short house connections as possible, and all deflections are made by special curved pipe. A man-hole is placed at every change in line or grade, and access is had to the sewer through a tee at the bottom

of the man-hole, and also at the junction of house connections with the main line where the Y branch has cast in connection with it a vertical tee, from which a pipe is carried up to the surface of the ground.

"Any man-hole may be used for flushing purposes. The flushing and cleaning are done very effectually by using a 'pill,' or spherical hardwood ball, five and one-half inches in diameter. This has proved more effective than one of smaller size.

"The two branch sewers unite near the rain-water reservoir, and continue to the boiler-house and laundry, near which is placed the sewage tank, in which the solid matter in the sewage is allowed time to deposit itself on the bottom, and the partially clarified liquid is retained until it is desirable to discharge it into the sub-surface tiles.

"The map herewith will give an idea of the general arrangement:"



SEWAGE DISPOSAL SYSTEM.

"The sewage tank is built of brick-work underground, and is in two sections. The first or retaining section is in duplicate, and contains six compartments, three in each set. Each compartment is sixty feet long, about three feet wide and four feet deep.

"The sewage flows into one end of the first compartment, passes along its whole length, and at the other end passes into the second compartment through a quarter-bend pipe, with the mouth turned down below the level of the outlet, to prevent scum on the surface of the liquid from passing over into the second compartment, through which the liquid passes to its further end, and in like manner into the third, at the further end of which it passes over a weir into the receiving chamber, which is circular in form, twenty-five feet in diameter and eight feet deep. From this it is pumped by a pulsometer pump as often as necessary. This chamber is ventilated by a pipe leading into the flue of the boiler-house chimney. It is intended that whenever solids collect in such quantities that the settling compartments require cleaning, the sewage shall be turned into the duplicate set, and the sludge removed from the first.

"It is found that nearly all the solids are deposited very near the entrance in the first compartment, and to cause the deposit to be distributed more evenly over the bottom, the water in the first compartment has been siphoned into the receiving chamber two or three times within the past six months. The rapid subsidence of the water, and the flow of incoming sewage during this operation, distribute the solids over the bottom, and enable the compartment to be used longer without cleaning out than would be the case if this distribution were not made.

"The pulsometer has been so arranged that by attaching a suction-hose, the water in the settling tanks can be pumped out and carried 300 feet through a hose to farm land ploughed to receive it. In January, 1887, the tanks were thus emptied, and the sludge then removed by a farmer to whom it had been sold. There were about 300 cubic feet of sludge removed from the first section of each of the settling tanks.

"The irrigation ground comprises about one and three-quarter acres, in the lower part of the school grounds, between the boiler-house and the brook. It is still further limited in location by the dam and pond on the westerly side, and an adjoining owner on the easterly side. It is the lowest portion of the school property, is naturally wet, and that portion near the brook (before drainage) was swampy. Its selection was a matter of necessity, it being all the land available for this purpose.

"The natural surface of the ground was on a quite uniform slope from the higher portion to the brook, so that very little surface

grading was necessary, but its thorough subsoil drainage became of the greatest importance.

"To accomplish this, parallel lines of two-inch round agricultural tile were laid, forty feet apart, discharging into the brook.

"These drains were laid four feet below the surface wherever the elevation of the brook permitted this depth; but, by reason of the elevation of the brook, the lower part of the drains was not deeper than from two to two and one-half feet, and the average depth is not greater than three feet.

"These drains were effective in drying the ground and preparing it to receive the sewage.

"The distributing or sub-surface tiles were laid about eight inches below the surface, in nearly parallel lines five feet apart, on uniform grades of nine to twelve inches in 100 feet.

"They are two inches in diameter and in twelve-inch lengths.

"They are laid on bed pieces of the same material and length, which cover the bottom joints. Smaller pieces cover the top joint, leaving an opening on each side of three-quarters by one-eighth of an inch, out of which the water escapes into the soil.

"The water enters these lines of sub-surface drains from a four-inch carrier leading from a chamber into which the pulsometer discharges, and in which are the two four-inch carrier pipes leading to different parts of the ground, into either of which the sewage can be turned at pleasure and the two sections of the field used alternately.

"A special branch joins the two-inch distributing tile with the four-inch carrier, the two-inch tile being so attached that its bottom is at the same level as that of the carrier from which it branches, so that if but little sewage is flowing in the carrier each line of drain will get its share, those in the upper portion of the field being prevented from surcharge by either flattening the grade or throttling the first section of drain.

"There are about 600 feet of four-inch carrier pipe, and about 20,000 feet of two-inch drains on the one and three-quarter acres of ground.

"The amount of sewage water averages 6,000 gallons a day.

"This is discharged into the irrigation tile eight times a month, or from 20,000 to 25,000 gallons at a time. The discharge from the outfall drains begins very soon after the tile are charged, showing the ground to be very porous.

"No complaint has been made of any offensive odor or fouling of the stream.

"The irrigation ground is not worked to nearly its capacity, as it has been found that the sewage does not flush the tiles fully to the lower extremity of the lines, and while the growth of the grass on the upper end of the lines is luxurious and rapid, the ground over the further end has remained bare or with very scanty vegetation."

The next, which is sometimes called the small-pipe or superficial underground system, is in use considerably in parts of Essex county, and has some special adaptation for private residences and smaller institutions where there are no sewers. It is based upon the idea that it is better to dispose of liquid sewage in the ground near the surface than upon it. To this end, a tract of ground is chosen which is porous and free of water near the surface. If not so by nature or position it is made so by deep and thorough drainage. The ground being found or made suitable, agricultural tile are laid in from five to ten inches from the ground surface, so that, receiving the sewage, it may pass out at the joints and be distributed to the soil. In order, however, to accomplish this fully for long periods of time, it is found necessary not to have the liquid dribbling through the pipes, but to send it through from time to time with some rapidity. This enables the pipes and the ground adjacent to be occupied in the intervening time by air, so necessary for the natural disposal of sewage. The rapidity of motion also causes a flush, and so keeps the pipes in order. To accomplish this purpose, a form of siphon is used, generally in the form known as Field's flush-tank. As Mr. G. P. Olcott, of Orange, has put in a large number of these systems, he has furnished us with this valuable outline of the methods of the administration needed and of circumstances and locations favoring its use.

THE SMALL-PIPE UNDERGROUND INTERMITTENT SYSTEM OF SEWAGE DISPOSAL.

BY GEORGE E. OLCOTT, C.E.

The system of which I am asked to write is variously called the sub-surface irrigation, the small-pipe, the absorption tile and the interrupted, downward filtration system, If called by the latter name, it must not be confounded with the method of surface irrigation generally known as the intermittent downward filtration system. The main features of the system were so well described in December, 1884, by J. W. Pinkham, of Montclair, in a paper read before the New Jersey Sanitary Association, that, by permission, I quote therefrom, and also give from it a few of the references to specimens of the system mostly put in under my direction:

"The method provides for the intermittent distribution of liquid sewage through a system of small unglazed earthen pipes, laid with *open joints*, from eight to sixteen inches below the surface of the

ground, having such relation to each other and to the soil in which they are laid, both as regards its density and slope, that the liquid flowing through them will find its way readily into the ground, but be sufficiently retained to reach the whole system of distributing-pipes.

"It is necessary for the success of this system that the ground employed should be drained, either naturally or artificially, so that absorption will take place promptly, and that there should be a *flush tank* discharging its contents through an automatically-acting siphon. There should be such relation between the size of this flush tank and the soakage area, that the whole system of pipes will be filled at one discharge of the tank, and such relation between the whole amount of sewage to be disposed of and the soakage area employed, that the liquid from one discharge of the tank will have become absorbed by the soil into which it is distributed, before a second discharge. To adjust all these requirements perfectly, demands a nice judgment and a skillful hand. The nature of the soil must be taken into consideration. A clayey soil may be too retentive, and a soil composed mostly of sand may be too loose for the perfect working of this system; but, as the area required is small, it would cost but little to add sufficient sand to the former, and sufficient clay to the latter to render it suitable. When organic matter is absorbed into the soil near the surface, as provided for by this system of sub-surface irrigation, coming in contact as it does, in a state of minute subdivision, with the air and condensed oxygen contained in the porous soil, it undergoes a rapid oxidation.

"The change which takes place is in every essential particular equivalent to that of combustion. The organic matter thus treated is just as much destroyed as if it were burnt, and the resulting products are as harmless as the products of combustion of wood or coal. Soil which has been used in this way for many years has been found to be but little changed, the liquid resultants of disintegration having evaporated or become absorbed by the roots of plants, while the solid resultants which remain, but slightly (and not in any essential particular) differ from the original constituents of the soil. Theoretically this system is perfect, but, the question, 'will it work in actual practice?' is legitimate, and is constantly asked. The best answer to the question 'will it work?' is the answer to the question 'has it worked?' The principal object of this paper is to present the testimony of those who have had practical knowledge of this system—of the engineers who have constructed the works, and of the owners of places on which the system has been tried. The word 'tried' has been used intentionally, for no system can be recommended for adoption, however perfect it may be in theory, until it has been subjected to the crucial test of prolonged trial, and it is important to know, not what a system will do under skillful management, but what it will do under the somewhat negligent management which it

is likely to receive. A system which requires for its operation the constant supervision of an expert, will fail on account of the impossibility of obtaining such expert supervision. In studying this system at the present time, we are fortunate in being able to form our conclusions concerning its merits, not from the reasonableness of its theory, nor the weight of opinion which supports, but from the testimony of those who have tried it.

"In collecting this testimony, I have been aided by Mr. James C. Bayles and Mr. George P. Olcott, civil engineers of Orange, who have kindly furnished me with the names and addresses of their patrons. To secure the desired information I addressed the following circular to about 60 people who for various lengths of time have employed the sub-surface irrigation system:

"'DEAR SIR:

"'Wishing to collect facts concerning the practical working of the 'Small-pipe System of Inland Sewerage,' and learning that you have had opportunities for observing its operation, and forming an opinion of its merits, I take the liberty of sending to you the enclosed blank, which I will ask you to kindly fill out and forward to me by return mail. Yours, respectfully,

"'J. W. PINKHAM.

"'State:

"' 1. Size of family.
"' 2. Approximate first cost of system.
"' 3. Approximate cost of annual maintenance.
"' 4. Length of time in use.
"' 5. Is system free from nuisance?
"' 6. Is all house waste satisfactorily disposed of?
"' 7. Have stoppages occurred?
"' 8. Is the soakage area underdrained?
"' 9. Is it superficially dry?
"'10. Give any facts which you think may be of service in determining to what extent and under what circumstances this system can be recommended for general use.'

"The answers to these questions I will present to you as they have been received, omitting only the portions which are irrelevant. These answers constitute the testimony which I have collected concerning the practical working of the sub-surface irrigation system for the disposal of house-sewage.

NAME.	Size of family.	Approximate first cost of system.	Approximate cost of annual maintenance.	Length of time in use.	Is system free from nuisance?	Is all house waste satisfactorily disposed of?	Have stoppages occurred?	Is the soakage area underdrained?	Is it superficially dry?	Give any facts which you think may be of service in determining to what extent and under what circumstances can this system be recommended for general use.
C. M. Marvin, Montclair, N. J.	5	$200 00	$10 00	19 months	Yes	No	No	No	Yes	The women's prison at Sherborn, Mass., uses this method, and there is a large amount of water consumed there. You are probably aware of the particulars in this case. The tanks discharge 15,000 gallons at a time, and they discharge alternately into two sets of drains of 1000 feet each. At my own house I have had a switch put in the main sewer-pipe, so that I can use 200 feet alternately. By doing this I can distribute the liquid waste more evenly, and have a more uniform growth of grass on the surface of the ground. For in all cases the upper lines of pipe (those nearest the tanks) are apt to receive the larger quantity of waste, although they do not receive more than they can take care of.
Chas. Scheffiin, Plainfield, N. J.	8	....	....	5 years....	Yes	Yes	No	No	Yes	I consider the system in every respect adapted to suburban or any residence having a sufficient area of garden or lawn.
B. I. Tuthill, Montclair, N. J.	7	200 00	....	6 months.	Yes	Yes	No	No	Yes	So long as we have used it it has been very satisfactory, and it seems to be the best system we have tried.
S. C. Burdick, Brick Church, Orange, N. J.	14	1,000 00	10 00	3 years....	Yes	Yes	No	No	Yes	
E. Eaton, No. 19 Mercer St., N. Y.	6	350 00	12 00	6 years....	Yes	Yes	No	No	Yes	I consider this system as satisfactory as any, if not more so.
C. Morgan, Bordentown, N. J.	8	500 00	25 00	2½ years....	Yes	Yes	No	No	Yes	You have the facts above, to which I have nothing to add save the opinion that it is a perfect success.
J. P. Davis, No. 21 Maiden Lane, N. Y.	10	170 00	....	2½ years....	Yes	Yes	No	No	Yes	
J. E. Pulsford, 45 William St., N. Y.	15	400 00	20 00	3 years....	Yes	Yes	Yes	No	Yes	It can be recommended.

Name.	Size of family.	Approximate first cost of system.	Approximate cost of annual maintenance.	Length of time in use.	Is system free from nuisance?	Is all house waste satisfactorily disposed of?	Have stoppages occurred?	Is the soakage area underdrained?	Is it superficially dry?	Give any facts which you think may be of service in determining to what extent and under what circumstances can this system be recommended for general use.
J. W. Towne, 140 Nassau St., N. Y.	14	$100 00	$10 00	10 years	Yes	Yes	No	No	Yes	
J. E. Knapp, 24 Pine St., N. Y.	9	250 00	15 00	3 years	Yes	Yes	Yes	No	Yes	
W. F. Havemeyer, 112 Wall St., N. Y.	6	200 00	12 00	3 years	Yes	Yes	No	No	Yes	System is the best devised where there is sufficient room for pipes in dry lawn free from shade. I empty settling tank about twice a year, though it is not absolutely necessary.
Dav. Bingham, New Produce Exchange, N. Y.	12	250 00	....	5 years	Yes	Yes	No	No	Yes	The system I consider perfect, wherever the party adopting it controls sufficient area for adequate distribution of the "small" or distributing pipes.
Ham. Wallis, 48 Wall St., N. Y.	9	350 00	10 00	2 years	Yes	Yes	No	No	Yes	
S. C. Howes, 52 Wall St., N. Y.	8	250 00	25 00	1 year	Yes	No	No	No	Yes	I recommend it freely for general use where conditions and space of ground are favorable. The settling tank needs cleaning out by removing the solid matter twice a year, or oftener, and the ventilation pipes need to be carried high above ridge of dwelling, to prevent any odor being blown down by the winds.
R. C. Browning, 82 Cortlandt St., N. Y.	8	500 00	15 00	4 years	Yes	Yes	No	No	Yes	
B. Shepard, 26 Worth St., N. Y.	7	....	....	5 years	Yes	Yes	No	No	Yes	
Rowland Johnson, 5 Mercer St., N. Y.	8	380 00	10 00	19 months	Yes	Yes	No	No	Yes	
Saml. Crump, Montclair, N. J.	10	175 00	10 00	8 months	Yes	Yes	No	No	Yes	

NAME.	Size of family.	Approximate first cost of system.	Approximate cost of annual maintenance.	Length of time in use.	Is system free from nuisance?	Is all house waste satisfactorily disposed of?	Have stoppages occurred?	Is the soakage area underdrained?	Is it superficially dry?	Give any facts which you think may be of service in determining to what extent and under what circumstances can this system be recommended for general use.
E. A. Bradley, Montclair, N. J.	9	$225 00	....	4 years....	Yes	Yes	No	No	Yes	During the last three years there has not been the least trouble with the system.
Francis Speer, 135 Duane St., N. Y.	8	250 00	$20 00	5 years....	Yes	Yes	No	No	Yes	I have my tanks or brick cesspools opened every three months and the solid matter removed and mixed with the manure heap.
John T. Rockwell, 101 Duane St., N. Y.	7	400 00	15 00	2½ years....	Yes	Yes	No	No	Yes	Have two three-inch ventilating pipes extending above the house roof, one inside and the other outside of the house, together ventilating the entire system. The above is my only experience with this method of disposing of house waste. Thus far it is satisfactory.
W. W. Underhill, Montclair, N. J.	12	185 00	....	18 months.	Yes	Yes	No	No	Yes	My experience and knowledge lead me to believe that this system might probably be safely recommended for general use in a town as thickly settled as Montclair; no facts leading to an opposite conclusion have as yet come under my observation.
Henry M. Oddie, 23 Nassau St., N. Y.	9	300 00	12 00	3½ years....	Yes	Yes	Once	Yes	Yes	I can only speak from personal experience, that the system has been very satisfactory.
A. D. Palmer, Brick Church, Orange, N. J.	8	200 00	....	3 years....	Yes	Yes	Yes	No	Yes	I regard the system as fairly successful, and the next best to the small pipe sewer system.
Charles A. Sterling, 55 Broadway, N. Y.	10	400 00	12 00	1 year......	Yes	Yes	No	No	Yes	I consider the system excellent if properly constructed, and sufficient area on the premises available for the distribution of the sewage. If the work is thoroughly and scientifically done, I would recommend it for general use, but otherwise it (the system) would be worse than useless. I have the system in use on my property, corner E. Park street and Washington, for about four years without any cost for repairs, and now working very satisfactorily.

NAME.	Size of family.	Approximate first cost of system.	Approximate cost of annual maintenance.	Length of time in use.	Is system free from nuisance?	Is all house waste satisfactorily disposed of?	Have stoppages occurred?	Is the soakage area underdrained?	Is it superficially dry?	Give any facts which you think may be of service in determining to what extent and under what circumstances can this system be recommended for general use.
R. C. Ryerson, Caldwell, N. J.	9	$200 00	$10 00	3 years	Yes	Yes	No	No	Yes	
Essex County Penitentiary, Caldwell, N. J.	150	500 00	50 00	4 years	Yes	Yes	No	No	Yes	The distributing pipes were first laid so that fluid from the tanks reached only a portion of the soakage area, and there was, consequently, supersaturation. At present there is no difficulty with the system, and it gives entire satisfaction; 5,000 gallons of water are used daily. Since the introduction of this system there have been no cases of typhoid in the institution; previously there had been cases.
Geo. E. Simpson, Orange, N. J.	12	240 00	15 00	8½ years	Yes	Yes	No	No	Yes	
W. H. Jewett, Montclair, N. J.	4	225 00	10 00	1 year	Yes	Yes	No	No	Yes	I have studied the system and believe there is nothing in the world like it for suburban and country places.
Mrs. G. W. Thorp	5	550 00	12 00	18 months	Yes	Yes	No	No	Yes	I take pleasure in returning the inclosed blanks, filled out as per request of Mr. George P. Olcott, who inserted the system under discussion (with modifications of his own, and with which I suppose you are acquainted) in two of my lots in East Orange. A third place in Main street is in working order, but has not had the test of time as yet. I shall be glad to furnish you with any particulars in regard to these three systems at any time.
J. G. Thorp, Brick Church.	4	450 00	12 00	16 months	Yes	Yes	No	No	Yes	
Robt. Lane, East Orange, N. J.	6	250 00	12 00	2 years	Yes	Yes	No	No	Yes	
A. W. Greene, 51 Leonard St., N. Y.	10	250 00	12 00	15 months	Yes	Yes	No	No	Yes	My impressions are so favorable at this time that I would not avail myself of public sewerage if we had it.

NAME.	Size of family.	Approximate first cost of system.	Approximate cost of annual maintenance.	Length of time in use.	Is system free from nuisance?	Is all house waste satisfactorily disposed of?	Have stoppages occurred?	Is the soakage area underdrained?	Is it superficially dry?	Give any facts which you think may be of service in determining to what extent and under what circumstances can this system be recommended for general use.
J. R. Howard, Montclair, N. J.	14	$190 00	....	6 months	Yes	Yes	No	No	Yes	My family has used about 350 gallons of water per diem (to the great grief of the pumper), so that I think the system has been pretty severely tested there. It cannot, however, be fairly judged until we shall have had both winter and summer experience of it, with the full alteration of discharges mentioned in No. 5, since we did have more or less foul odors for some time, where the ground was evidently oversoaked and could not take care of the water.
Orange Memorial Hospital, Orange, N. J.	40	1,000 00	$35 00	2½ years....	Yes	Yes	No	No	Yes	Experience in this case shows that underdrainage is indispensable when an area not naturally well drained is expected to take up a large amount of sewage. With good natural drainage and a small amount of sewage to dispose of, the benefits of underdrainage are less apparent, though it is desirable in all cases. The soil is underlaid, at the depth of 18 to 21 inches, by a layer of hardpan, and the soil before the underdraining was continually water-soaked during rains.
Jno. W. Handren, Dunellen, N. J.	8	....	....	3½ years....	Yes	Yes	No	No	Yes	I think it is the only system that can be used successfully for inland drainage, and, in my opinion, if it was universally used, we would have less fevers, sore throats and throat diseases of all kinds than we now have.
E. O. Doremus, Newark, N. J.	8	1,000 00	10 00	3 years....	Yes	Yes	No	Yes	Yes	

"In order that the negative and affirmative answers in the foregoing table may convey no wrong impression, I desire to say that in the few cases where qualified answers were given, they are represented in the table by a 'yes,' which in the answer was 'yes, to a small extent,' and by a 'no,' which was 'no, not to any extent,' or words of similar import. Without this explanation the tabular statement would be less favorable to the system than were the answers received, which in no case represented that there had been serious difficulty, or that there was dissatisfaction with the system.

"My conclusions, says Dr. Pinkham, are as follows:

"2. The first cost for a family and house of average size is about $200.

"3. The cost of annual maintenance is about $10 for such a house.

"4. The ground selected should be free from shade, and may be either lawn or garden.

"5. By means of this system all liquid sewage from the smallest dwelling-house or the largest institution may be effectually disposed of without nuisance and without peril to health.

"6. This system should take the place of cesspools in all suburban and country places which have sufficient ground for the distributing of pipes."

This description and indorsement entirely accord with my own views after having put in some seventy on this general plan. For the two years since this outline was written I have added several more, and believe they are giving satisfaction in all cases where there has been no mismanagement. It is always to be borne in mind that all details must be carried out both in construction and management. The ground must be properly prepared. The quantity chosen must allow for the amount to be disposed of thereupon. Storm-water must be excluded from the slops, so as not to increase unduly the quantity. The laying of the tile must be such as to insure complete distribution. The absorption is meant to take place at each joint, but if there are additional irregularities, stoppage or accumulation may occur. The pipes allow full circulation of air through them and the adjacent ground, which adds to the oxidation and the rapidity of disposal. The flush tank or siphon which receives the flow from the house is so made that when the liquid rises to a certain height it discharges itself of all its contents, thus securing a general distribution and a scouring of the pipes. Thus they do not get accumulation and stoppage, as they are so sure to do with a very light and inconstant flow. Where the system is properly put in and has some oversight it is surprising how completely all organic matter is disposed of. Cultivation and free croppage help the disposal. Occasionally the pipes and ground need inspection by some one familiar with details. Having long been

familiar with various plans of sewage disposal I regard this as having special adaptation where stream-sewers cannot receive the discharge, and as far preferable to cesspools. It returns organic material to its natural consumption in the ground and gives it as food to growing vegetation. While other and more extended systems have their peculiar adaptation for larger populations, this is often available in smaller communities or for individual homes.

The next plan presented deals with sewage by methods of subsidence and chemical purification, then passing it upon land, and finally as a purified effluent into a stream. It brings into prominence a system rapidly coming into use by which the grosser matters are so removed from sewage and compressed as to be transportable, thus leaving an effluent greatly reduced in its proportion of organic matters In order still further to remove any dissolved matter it is then passed over land and so into an adjacent stream. Thus, far less land is needed and the small stream not polluted.

This system has been planted at Long Branch and at East Orange, under the superintendence of C. P. Bassett, C.E., of Newark. We are able to present his own description of one of these methods in detail.

DESCRIPTION OF LONG BRANCH SEWERAGE SYSTEM, AND NOTE AS TO EAST ORANGE SYSTEM.

BY C. P. BASSETT, C.E.

In the fall of 1884 the local health authorities consulted me on the introduction of sewerage in Long Branch. The sanitary condition of the town had attracted the attention of the State Board, who cited the peculiar dangers to which the town, as a health resort, was subjecting itself.

An investigation of the case unearthed obstacles not legitimately in the province of the engineer to surmount. It was found that urgent need existed for efficient removal of sewage, but it appeared that the limits of bonded indebtedness allowable to the Board of Commissioners (the governing body) had been almost reached. Special action, necessary to secure an increase, but dependent on popular vote, would probably have been defeated. It was finally decided to put the matter in the hands of private capital. The necessary legislation was obtained, and a private company incorporated under the State law, to introduce

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sewers. It was recognized by the promoters of this enterprise that sanitation should not be dependent on the success of a financial investment. To reduce this objection, property-owners were interested to control the company, it being argued that public-spirited men deeply interested in local affairs, could best be entrusted with a matter so intimately related to the health of the city. In the winter of 1885–6 surveys were made and plans perfected. In the following spring, the main portion of the system as now existing, was constructed. The question of the disposition of the sewage was of prime importance. It was stipulated that no objectionable matters should be poured into adjacent waters. The introduction of some process of purification was therefore necessary. It was believed that the requirements for an effluent to be discharged into the ocean might be met by an inexpensive, mechanical filtration. Such a process was introduced, and is cited as the first attempt in this country to treat sewage on a large scale in restricted quarters, surrounded by a compact population, without nuisance.

The topography of the town is simple. A ridge twenty feet above mean tide rolls up from the beach, and falls easily back to a parallel valley 500 to 600 yards from the beach, which averages nine to ten feet above mean tide, throughout the length of the town. The west slope of the valley rises gradually for a fraction of a mile, where it again dips to form a secondary valley. This second ridge is intersected by several streams and depressions. It would have been a simple matter to construct sewers adapted to the needs of the built-up portion of the town, but to design a comprehensive system capable of extension and development to meet the needs of the entire adjacent territory, and conditioned on the location of the works for the treatment of the sewage, was a complex problem of considerable magnitude and required an expense in construction only justified by the demands of the future, and in the making of which the company demonstrated their good faith and determination to meet the needs of the entire community.

The system constructed is the "separate" system. The sewage is collected in vitrified pipes (eight-inch being the minimum) into the main which flows in the principal valley (twenty-four-inch being the maximum), passes through the building where it undergoes the treatment; thence to the tidal chamber, in which it is controlled by automatic valves and discharged on the outgoing tide into the ocean,.

through a wrought-iron pipe, supported on piles, and extending 200 feet from shore.

Man-holes are placed along the lines at intervals not greater than 300 feet, and at all deviations of aligoment or grade, securing control and location of troubles in the pipes. The covers are perforated to secure ventilation, and buckets are to be hung just beneath the cover to catch dirt and sand falling through the holes.

As the sewers are designed to accommodate the maximum flow of the crowded season, the main does not receive cleansing flow during a large portion of the year. Arrangements are made for liberal flushing along the lines, and in some locations the brook can be turned into the sewers.

In the section of the town to which the sewage would gravitate, little available land for treatment-works could be obtained; and the main sewer was necessarily located at so small a height above mean tide that considerations of economy dependent on a gravity outlet, demanded that the shortest line to the ocean be provided. This prevented any lengthy detour of the main sewer to treatment-works and virtually determined their location. A small plot of ground, 100x100 feet, on Long Branch avenue near Second avenue, was finally procured and the works erected there. The building is surrounded close on every side by dwellings and shops. Chemicals (lime, alum, &c.) are mingled with the sewage at its entrance to the works. Together they flow into the receiving tanks, which are constructed in duplicate, of concrete, and receive the sewage alternately, the one being cleaned while the other is in use. The course of the sewage in the tanks, under planks floating on edge, over walls, through submerged arches, as shown in the accompanying sketch, is such that in the thirty-feet flow a large part of the matters in suspension settle with the chemicals into the bottom of the tank; the sewage then enters the series of portable coke filters. Provision is made for four deep, narrow wire cages, sliding in guides and holding different sizes of coke. When the filters are clean a very fair purity is secured, and it is believed that the process is capable of considerable development. The coke when taken from the frames is used as fuel; it could with care be used again as a filter, effecting economy. The flow in the tanks is continuous. Considerable loss of head occurs in the flow through the filters, and when they are in operation the sewage has to be pumped up to the level of the gravity sewer. This is accomplished

by a six-inch centrifugal pump, built by the Weber Machine Company, of Lawrence, Massachusetts. When the filters are out the sewage passes through the works by gravity. After sufficient deposit is secured in one of the tanks the flow is diverted to the other, and the water is drawn down in the first tank nearly to the level of the sludge (or deposit); the remaining contents of the tank are then drawn into a wrought-iron sludge-receiver by creating in it a vacuum with a vacuum engine. From this receiver the sludge is forced by compressed air into Johnson's Filter-Press, where the liquids are pressed from the sludge, leaving portable cakes to be used as guano. A by-pass is arranged on the main sewer near the building, so that sewage, in case of accident or emergency and during the winter season, can be made to flow by gravity directly to the tidal chamber, avoiding the works. (The plant of the works is shown opposite page 88.)

The system was ready for use in the summer of 1886. And as soon as it was recognized that it was in successful operation applications for connection were rapidly made. The real test of the system has been made within the past year and the results appear to justify all that has been claimed for it.

It should be remembered that the purification attempted is merely mechanical—a removal of the matters offensive to the senses. That the sewage has been discharged without any complaint, in the midst of the surf-bathing, about 300 yards north of the iron pier, seems sufficient mention of its merits. The system is capable of development, and, as the needs arise, it is intended to extend the mains now laid to Elberon on the south, the upper village on the west and Monmouth Beach on the north.

EAST ORANGE SEWERAGE.

During the past five years special attention has been given by the prosperous inland towns in the State to the consideration of sewage disposal. The lack of available outlets has deterred even some of the more progressive communities from constructing sewerage systems. The removal of sewage in some form or other has in cases become most pressing.

The action of the East Orange authorities in constructing extensive and expensive works to purify their sewage is therefore being watched with no ordinary interest by communities similarly situated.

I have been engaged since May, 1886, as designing and construction engineer on the East Orange sewerage. Twenty-five miles of sewers and the purification works have been constructed and are now ready for operation. It seems proper at this time to merely call attention to the aims of the system, leaving until some future occasion a description of the works, when comments may be made on their operation.

Large concrete tanks holding 200,000 gallons will receive the sewage after the admixture of the chemicals. The effluent from the tanks will be filtered through the soil (twelve acres have been prepared) before discharge into the stream. A high chemical purity will therefore be maintained. This final effluent from the works flows into Second river, a tributary of the Passaic, just below the "in-take" of Newark's water-supply. This dual process of purification is introduced for the first time in this country on a large scale. The process is quite similar to the Coventry works, England, such changes being made in the general plan as were suggested to the writer after a most careful examination of European works and consultation with the English authorities. The latest improvements in filter-pressing machinery have been introduced by S. H. Johnson & Co., of Stratford, England, through their New York house. The present population of East Orange is 12,000.

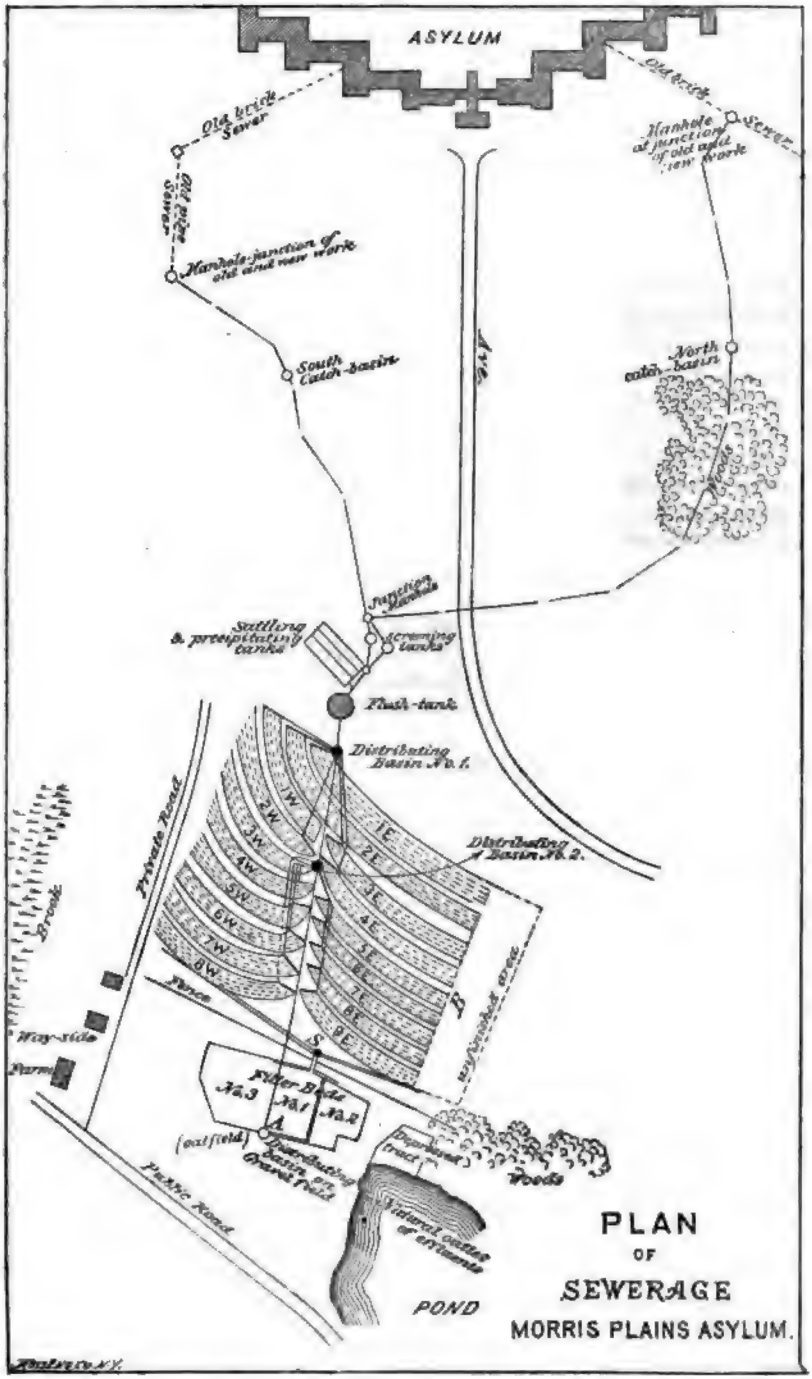
DESCRIPTION OF SEWERAGE SYSTEM AT MORRIS PLAINS.

BY PROF. C. MCMILLAN.

The remaining system which we notice is that which has been planted at *the Asylum at Morris Plains.* It is intended to combine the value of separating screens for the coarser material, subsidence tanks and filtration by a small pipe or absorption tile system and then pass any effluent into a pond or stream adjoining. There is also constructed a long precipitating chamber for use so far as it may be found necessary.

We are authorized to make extracts from a report of it by Prof. McMillan, the Engineer in charge. As the system is not yet completed in all its details, the description is not quite full on every point, but sufficiently so to give an outline showing the plans.

"Starting from the uppermost points, we first reach the N. and S. catch-basins, in which rough screens are intended to arrest bulky foreign matters. They are either raked out by hand or drawn out by the odorless excavator.


ASYLUM
Old brick Sewer
Old brick Sewer
Manhole-junction of old and new work
South Catch-basin
Manhole at junction of old and new work
North catch-basin
Woods
Ave.
Junction Manhole
Settling & precipitating tanks
Screening tanks
Flush-tank
Distributing Basin No. 1.
Distributing Basin No. 2.
Private Road
Brook
Fence
Way-side
Farm
Filter Beds
No. 3
No. 1
No. 2
(oatfield)
Distributing Basin on Gravel Field
Woods
Public Road
Natural outlet of effluents
POND
PLAN
OF
SEWERAGE
MORRIS PLAINS ASYLUM.

"Next we come to junction man-hole, which simply unites the streams and enables us to shoot the liquid into one or the other of the two screening tanks. The liquids from the screening tanks again unite at a man-hole adjacent to the settling and precipitating tanks, thence the sewage can be run at will to surface, or to these tanks, or directly to the flush tank. The ordinary course will be to the settling tanks, thence to flush tank, and thence out into the absorption tile, or out on the surface of sloping field, or out on the filter-beds direct. Of course, the first destination is the one designed.

"The sloping field is underdrained by tile drains (not shown on sketch) five feet deep, and at present forty feet apart. To complete the drainage, extra drains will have to be interposed so that the deep drains will be twenty feet apart. All these drains, which will be under the ground occupied by the absorption tile, deliver through two six-inch collectors into a man-hole (S on sketch), and thence the effluent can be delivered to either one of the three filter-beds on the gravel-field, or through a side outlet (not shown) into the brook, or through another side outlet on the depressed tract. Of the 120,000 feet of absorption tile in contemplation, we have only succeeded thus far in laying about 98,000 feet.

"On the sketch (page 93), the fine full lines traversing the shading, representing the lay of the absorption tile in the different sections, are the carriers (four-inch glazed pipe). They run under the sections which they pass, until they are within reach of their respective sections, where each one of them is coupled to its particular section. The carriers start always from a basin where, in the first place, the same static head is secured for each carrier, and, secondly, since the carriers have different grades (some of them very steep) the delivery from the basin to each carrier is regulated by a disc-valve.

"It was important to have a uniform static head at each basin. An assistant sent the first one-third of the flush, which is nearly twice as rapid as the last third, through the six carriers, feeding about 35,000 feet of pipe (it is intended that not less than twelve carriers should be exposed to the flushes), and his report was to the effect that it worked completely. Six carriers, instead of twelve, were working for at least half an hour, and not a sign of water at the surface. The flush which was sent into these tiles must have been at least 25,000 gallons.

"There are bends or returns in the lines of carriers for the purpose of economizing ground and to lay the distributing tiles on flat grades. The subdrains are all parallel and terminate in the six-inch collectors, represented by double interdotted lines meeting at S, a man-hole beyond what is shown on the sketch. A section of absorption tile is left out from the sketch, owing to overcrowding the drawing.

"The full black line running directly from the flush tank to the distributing basin A, in the gravel, is the delivery main which has been in use all summer. The distributing basins (Nos. 1 and 2) are built

on it, and also a small man-hole near the foot of the slope, which operated as an air-vent during the direct discharge on the filter-beds.

"The flush tank is fifty feet in diameter with a depth of flush of a little more than five feet.

"The settling tanks galleries consist of three chambers, each one hundred feet long, by five feet wide, by four feet deep. The idea is, as far as possible, to receive the sewage in No. 1, thence let it divide over an apron at the rear ends of the tanks into tanks Nos. 2 and 3, thus reducing the flow in Nos. 2 and 3 to one-half of that in No. 1. But, of course, this proportion will be disturbed whenever one of the tanks needs cleaning.

"For precipitation it is proposed to place a hopperful of crude sulph. alumina directly over the mouth of the outlet of the screening tank, and to supplement this at the man-hole lower down and adjacent to the settling tanks by the drip from a hopperful of *lime-water* (not milk of lime). There is considerable natural agitation of the liquid between these two points, and there will be still more on entering tank No. 1. This will not be as thorough as mechanical agitation, but it is thought that it will answer the purpose. The outlets for drawing of liquid for cleaning the tanks are not shown. They are at the rear of the tanks.

"The stop-planks are so arranged that if No. 1 needs cleaning the sewage flows into No. 2, and thence through No. 3. If No. 2 is to be cleaned the course of the liquid is through No. 1 into No. 3. If No. 3 needs cleaning the course is through No. 1 into No. 2. The movement in the tanks is for 150,000 gallons per diem, at the rate of about one-eighth of an inch per second.

"We may find it desirable to use an emulsion of clay. But that can only be determined by experiment.

"The sludge is to be moved in the tanks by a drag scraper worked from end man-holes, and taken out by 'odorless excavators.'

"We have made provision so that if it is ever found advisable to institute a precipitating process, pure and simple, with intermittent filtration, the flush tank can be thrown into the precipitating system, forming the terminal tank.

"1. The sewers are first-class. There is not a better piece of work in the State. The grades are $1\frac{2}{10}$ per cent. and $1\frac{4}{10}$ per cent., but the laying and alignment are very superior.

"2. The screening tanks will do their work fairly well. We will put in duplicate screens so that one can be in place before the other is removed for cleaning. Some slight changes in these may be needed.

"3. The settling tanks are large and the movement through them is as before stated.

"4. The flush tank is excellent and has some special improvements.

"5. The absorption tile has received a very severe test and verified the correctness of calculations. All of it is not in, however, and can-

not now be put in before winter, and that which is down will therefore have to be used only moderately, especially because the extra subdrains are not yet in. But it can be used and can take care of every alternate flush, provided the flushes are not more frequent than every twelve hours. Even that will be dealing with 160,000 instead of 150,000 gallons. A good deal of adjustment will be needed where the absorption tile cross newly-made trenches, for the simple reason that we cannot pack filling, in one or two months, during one summer, so that it will not settle further.

"6. The underdrains will be *doubled* in order to secure quick drainage, in wet weather especially.

"7. The entire amount of absorption tile required is simply a matter of judgment after we have fully seen how the field behaves and whether there is need of increase."

The attention of our citizens has during the past year been more fastened upon the conjoint interests of water-supply and sewerage than ever before. It is evident that most of our growing towns are compelled to arrange as to these more fully. Those cities are wise that do not delay too long and that settle upon a method while land is cheap, or that avail themselves of the many recent and economic methods which have been devised. It has been one of the privileges of this Board to co-operate with individuals and Local Boards in presenting the necessity for liberal and complete arrangements for the disposal of sewage. It is encouraging to be able now to point to such systems as those herewith described. It is our hope in the subsequent report so to outline methods and so to present and criticise the various systems in operation in this State as to give aid to our citizens in projecting new plans or in improving those already in use.

EXPOSURES AND DISEASES OF OPERATIVES.

During the past year as far as practicable the Board has continued its inquiry into the condition of workshops and factories and as to the influence of the various trades and occupations upon the lives and health of operatives. Each new inquiry, when made for a long period and with skill, reveals the fact that in many industries the years of productive labor are greatly shortened by sickness and by too early deaths. The system of expert factory inspection pursued in England and in some countries on the continent has plainly shown that very many of these results are largely preventable. This is a part of the service of the Board that could be greatly extended with advantage. Our former reports on this subject have proved of much value, but there is need of something more than advice. The chief report of this year is upon the pottery industry. We have also employed a competent person to examine as to the woolen and cotton factories of the State. It is our intention, as the means are provided, to extend this inquiry to all the important industries of the State.

THE DISEASES OF POTTERS, THEIR CAUSES AND PREVENTION.

BY DAVID WARMAN, M.D.

In the capital city of this State there are located twenty-one potteries, beside two tile factories and twelve china decorating establishments, in which over five thousand men, women and children are employed, and over a million of dollars of capital are invested. Indeed, so large and important has this industry become in Trenton, that this city is popularly known everywhere throughout the United States as the "Staffordshire of America."

An industry that employs so much capital and labor is certainly worthy of more than a passing notice, especially when so many of our fellow-citizens are engaged in an occupation that is generally considered deleterious to life and health.

Unhappily, we cannot disguise the fact that the potters' trade is an unhealthy one. The question is, can it be made less so? We think it can.

Having made careful and minute inquiry into the varied occupations of potters we find that those engaged in this industry are more or less subject to the following diseases, viz.: 1. Potters' asthma and potters' consumption. 2. Lead-poisoning. 3. Rheumatism, acute and chronic, and its allies, lumbago, sciatica and its frequent complications of diseases of the heart, together with variously-placed nerve pains or neuralgia. 4. Disorders of the digestive organs, liver and stomach. 5. Anæmia and bloodlessness, with general debility. Lastly, in case of females, various local derangements and sufferings peculiar to the sex.

In order to show how the above-named diseases are more prone to develop among potters, it will be necessary to point out the manner and kind of work and the character of the materials used in the manufacture of the various kinds of pottery products.

NATURE OF THE OCCUPATION.

The manufacture of earthenware comprises many processes which do not all affect the operatives engaged in them in the same manner or to a like extent. There is also in some of the processes a material difference as regards their influence on health, according to whether the articles manufactured be of earthenware or china. Indeed, in some of the processes, as for example in biscuit-rubbing, the quality of the article diminishes or enhances the probability of the process being injurious to the health of the person engaged in it.

Of the various departments of the manufacture of earthenware several require special notice from the circumstance of their being those to which the prevalence of pulmonary diseases among potters must be ascribed.

The operatives employed in these branches of labor may conveniently be named, from the nature of their labor, *slip-makers*, *mould-makers*, *potters* (properly so called), *turners*, *placers*, *china scourers* and *decorators*.

Slip-makers are the men employed in preparing the clay or material of which earthenware is made. After the several substances of which the clay is composed, such as the different china clays, flint and spar,

have been thrown into a tub, or blunger as it is called, and have been ground into a state of comminution, they are mixed and diffused in water so as to form a fluid. This "slip," as it is then called, is pumped out of the blunger and deposited on the face of lawns. When the slip has been passed through the lawns until all impurities are removed it is then run into the presses, where the water is forced out of the clay. The slip-makers are those who attend to the grinding and mixing of the clay, so as to form a dough suitable for handling. This work is often done in damp cellars, the workmen get wet, and it causes more or less rheumatism.

Mould-makers manufacture the plaster of paris moulds upon which the various articles are shaped.

A very little dust is evolved in the process, but a considerable quantity is apt to be raised from the floor by locomotion, and mould-makers are, as a consequence, liable to inhale air more or less charged with fine dust. Exposure to high temperature is not a necessary concomitant of the mould-makers' occupation, but some of the men being of irregular habits, and coming to work late in the day, are obliged to hasten the drying of the moulds by an increase of temperature, and are thus exposed to this additional risk.

Some of the mould-makers' shops are lofty and well ventilated, others quite the reverse. Ill-devised methods of ventilation are apt in this, as in other manufacturing processes, to fail in their design. In one of the mould-makers' shops visited, the men suffered from oppression of the chest, cough and expectoration, which they attributed, and no doubt correctly, to the bad ventilation and inhaling of impalpable dust. The evils contingent upon this branch of the business might be greatly diminished by more care being taken to avoid scattering the plaster over the floor, and by regularly sweeping the latter so as to allow as little of the material as possible to accumulate and be raised in the atmosphere by tramping about. The keeping of the mouth closed and breathing only through the nose, and the occasional cleansing and wetting of the nostrils, by a sponge, are of great service.

Potters.—Under this name are here included the operatives engaged in the following branches of manufacture: flat pressers, or dish, plate and saucer-makers; hollow-ware pressers; throwers, who shape vessels upon the wheel, and sagger-makers, who make the coarse earthenware vessels in which pottery ware is placed for baking.

Flat pressers are those who roll out a piece of dough, which, when of the proper thickness, they shape upon the mould. The material is used in a wet and ductile state, but bits of it get scattered over the floor, and, rapidly drying, are stirred up by the feet of boys and others, who are constantly running about the work-shops. The atmosphere is, therefore, more or less impregnated with a fine dust, clearly observable only when it lodges on a flat surface, or is seen in the sunshine during a bright day.

The quantity of dust varies, of course, according to the cleanliness of the place. Some shops are swept daily, others not so often, and, of course, those employed in the latter are more likely to inhale dust than those in the former.

Dish-makers are less exposed to heat and dust than plate and saucer-makers, the operations of the former being a slower process.

China flat pressers are less exposed to heat, but just as liable to inhale dust as those who work in the commoner material.

Saucer and plate-makers create much dust in giving an edge to them after they have been dried. Intermittent currents of hot and cold air strike the worker, and this, with the dust, is one of the causes of potters' asthma.

Hollow-ware pressers are exposed to much of the same influences as the flat pressers. Both flat and hollow-ware pressers stoop somewhat over their work, in order to make pressure against the moulds. This constrained position produces indigestion and is very monotonous and wearing upon the potters.

Throwers, who shape their work upon a wheel, sit at their employment with the wheel placed directly before them, over which they stoop very much, thereby compressing the chest and interfering with free respiration. They are exposed to dust from the shaking up of debris from the floor, but not to the same high temperature as the flat pressers.

Sagger-makers are those who make the saggers which are to hold the ware to be placed in ovens or kilns. They are subject to great vicissitudes of temperature.

Turners are employed in turning into a complete form the ware produced by throwers. The atmosphere of the turning-shops usually contains a proportion of fine dust, but in smaller quantity than the potters'-shops, properly so called. The turners' branch of the manufacture requires no heat, and the shops are, accordingly, for the most part cooler than those previously described.

Placers or *kilnmen*, are those who pack the ware in saggers, and afterwards place them in the kilns or ovens. Earthenware is surrounded in the saggers with sand, but china with flint-powder. In the process of placing the latter in the saggers a considerable quantity of flint-dust is said sometimes to be dispersed in the atmosphere, when not dampened. Placers are exposed to a high, oppressive temperature and unwholesome atmosphere in drawing the kilns or ovens —that is, in removing the saggers after the ware is baked. The results of such exposure other than inflammations of the chest or elsewhere, are witnessed in the shape of rheumatism and its allies.

The pottery workmen most liable to rheumatic affections are oven-men and kilnmen, who are greatly exposed to heat and strong draughts. If, however, this work be carefully done, the ovens being allowed to cool properly before the saggers are drawn, the danger to health would be greatly diminished.

China-scourers remove the loose flint-powder from the china after it has been baked. This is done, partly by dusting or brushing and partly by rubbing the china with sand-paper, during which process much fine flint-dust is dispersed into the atmosphere about them; a dust which is lighter and floats more obstinately in the air in proportion as the earthen-ware is fine. In the manufacture of the finer sort, the flint-dust is in the form of impalpable powder, that it may not scratch; in that of the inferior sort the flint-powder is coarser, and falls to the ground more rapidly. This dust, inhaled into the lungs of the work-people, is a terrible irritant to the bronchial surface which it invades.

The women and girls (for the occupation is a female one) soon get habitual shortness of breath, with cough and expectoration. Very often they have bleeding from the lungs; sometimes, also, from the nose, and their chronic affection is from time to time accelerated by more acute catarrhal attacks, to which they are particularly subject.

Indeed, the chief sufferers in the manufacture of earthenware are the china-scourers. Comparatively few continue long at the employment. All who do continue at it, sooner or later become asthmatic. Against the danger of this occupation scarcely any provision has been made.

Dippers—who dip the ware into a liquid glaze, containing oxide of lead, borax, Paris white, clay, flint, &c. The sufferers from the action of lead, besides the dippers and those assisting them, are glost-

placers, mixers of colors, ground-layers, majolica and other painters, and those who "fettle" ware after it is dipped.

Handlers—who make or fix the handles to jugs, cups, &c., are liable to suffer from the dust and heat of the work-shops when, as often happens, they are associated at work with operatives of some of the classes already described.

Firemen—and the men and boys who carry recently-made ware into the hot or green-houses, as they are sometimes called, places to which certain articles in a wet state are sent to be dried, are exposed to considerable alternations of temperature, and suffer the results.

Decorators.—Under this head are comprised the persons employed in engraving and printing designs to be afterwards transferred on to the ware, besides painters, gilders and burnishers. Not much of the latter, however, is done, except on very fine ware. All these branches of manufacture are of a sedentary kind, and are frequently carried on in ill-ventilated and over-crowded apartments. Sometimes they are over-heated, in consequence of the nearness of the ovens or fires which, in certain processes, are required in order to dry the articles when they have received the designs. Several of these are skilled branches, to which an apprenticeship is served, and many women and girls are found among the journey-women.

In the larger establishments there are often a great many persons collected in the work-rooms of these departments, more especially those in which women and girls are employed, and this over-crowding, combined with imperfect ventilation, often renders such rooms very unwholesome. Even where, as in the better class of potteries, means of ventilation have been provided, the operatives refuse to make use of them, or actually close them up, in order to exclude currents of air, to which pottery operatives, like most others, seem to have a great dislike. This objection might probably be obviated by the adoption of some improved method of ventilation, which should provide for a constant renewal of air in the apartment without sensible draught.

The Influence of the Occupation on Health.

The several processes of the manufacture just described directly or indirectly exercise an injurious influence on the health of the operatives in various ways, such as the respiration of the air more or less charged with fine, irritating dust; exposure to a dry, hot

atmosphere, or to a hot, moist atmosphere, or to great vicissitudes of temperature, or the habitually assuming a constrained attitude while at work. China-scourers are in general only exposed to the first of these influences, and theirs is the most pernicious branch of the manufacture. The fine flint-dust diffused through the work-shops and inhaled into the lungs very soon produces discomfort and a sense of oppression in the chest, soon followed by cough and expectoration.

China-scouring is performed by women, few of whom continue long at the occupation. Thirteen years is the longest time that any one person has continuously worked at this branch in *our* potteries. The danger to health varies, as said before, according to the quality of the china. Probably this most dangerous branch of the manufacture might be rendered less injurious to the health of the workers if some arrangement could be adopted for withdrawing the dust from the atmosphere, or perhaps the use of some kind of protection for the mouth, such as a respirator, might serve to exclude the dust from the air passages.

Potters, including under this head flat and hollow-ware pressers and throwers, turners and mould-makers, all suffer, but in a different degree, from inhaling air impregnated with impalpable dust.

Flat-pressers suffer most, turners and mould-makers least from this cause, the former because their work is more rapidly done. The boys and others are continually running backwards and forwards, thus raising the dust from the floor. The latter comparatively little, because there is less locomotion in their work-shops, and therefore less dust in the atmosphere. Flat-pressers are also exposed to another influence productive of bronchial irritation in the respiration of highly-dried hot air, caused by the heat of their work-shops. The evils incidental to these branches of the potters' calling might unquestionably be mitigated by increased cleanliness and improved ventilation, and by the adoption of such arrangements as would tend to moderate the heat of the work-shops.

Throwers suffer partly from the diffusion of impalpable dust through the atmosphere of their shops, but, in their own opinion, still more from stooping over their work, thereby compressing the chest and obstructing respiration. The men differ much as regards stooping, some leaning more over their work than others. The above influences, sooner or later, affect most of the throwers, and some of them rather *early* in life. Slip-makers suffer most from the relaxing influ-

ence of the hot, moist atmosphere, and the vicissitudes of temperature to which they are so much exposed.

We find that those engaged in the manipulation of the clay are the chief sufferers from chest diseases; such as throwers, flat and hollow-ware pressers and turners, among males, and china-scourers, among females. This being admitted, the next question is, why do these particular work-people so suffer? The answer beyond all doubt is, from the inhalation of dust. It is necessary to note here that besides the lung affections primarily due to dust, we have among us, also, an excessive prevalence of consumption, associated with tubercular disease. Unhappily, consumption is widely spread among all classes and all trades, and is by no means a special disease of potters. However, its production is favored and its mortality increased, by all causes operating prejudicially upon the lungs. Of such causes the inhalation of dust holds a foremost place, and it is owing to this fact that consumption claims a larger proportion of victims among pottery-workers than among most other artisans.

Habits of the People.

Further, the destructive action of inhaled dust is aggravated by every other condition or circumstance damaging the vitality of the whole body. Such conditions are (1) neglect of cleanliness in shops, in work, in dress and in personal habits; (2) inattention to ventilation, and to the heat and moisture of the air of the work-shop, and (3) intemperance, and irregular living and dissipation.

Granting that a certain measure of dust is unavoidable in the process of manufacture, the conditions damaging to health just enumerated are in the hands of the workmen themselves, and themselves alone, or, in some particulars, in conjunction with their employers. Surely our artisans are quite capable of keeping themselves and their shops clean, of lessening dust and of securing proper ventilation.

Likewise, if they will, they can repress irregularities in the condition and hours of labor, without perpetual oversight. It is to the interests of those employed, and, in a greater or less degree, of employers also, to insure every sanitary advantage, and to avoid irregularities in the work of a factory. As a frequent visitor to potteries, I noticed great room for increased cleanliness and carefulness in work. More clay is spilled about than the processes justify. Shops, their floors, benches

and shelves are not brushed and washed as often or as clean as they might be; there is too little sprinkling to keep the dust down; the clothes of the workmen are often of very unsuitable material, not as comely and clean as they might be, and too largely carriers of dust for future inhalation outside the shop.

There is an increasing number of new factories constructed, on more or less improved principles, with new machinery for facilitating and economizing labor, for securing the ventilation and warmth of the shops, and generally for bettering the circumstances and surroundings of the work-people. Nevertheless, much remains to be done, and many shops still exist which are unfit places to labor in, and detrimental to health. Yet the advantages of good shops will be lost to the careless workman.

He is but little better off than in an ill-constructed one, if he pays no attention to ventilation, cleanliness and heating. So, many treat themselves as hot-house plants, and such they become. The consequence is, they fall a prey to every cold current encountered, and lay the seeds of that chronic bronchitis which is the peculiar appurtenance of their trade.

Ventilation is air in motion, so that what of it has been rendered impure by breathing, by exhalations or by the processes of labor, becomes displaced and removed, and thereupon replaced by fresh air from without.

Stagnant air is made worse by heating it. Hence arises one defect of the warming of shops by hot water, hot air or steam-pipes. This mode of heating is rarely combined with proper ventilation, and as a result we have hot, close air, which favors the drying and diffusion of dust through the shop, which is productive of languor among the inmates.

A reference has been made to the ill-adapted clothing worn by too many potters. What is required is suitable light woolen, washing material, made into an easy-fitting garment, which, as a non-conductor, shall keep out both heat and cold from the surface of the body, and at the same time allow free transpiration. To make matters worse many of the workmen will frequently stand in their shirt-sleeves about the door or in the yard and catch the cold which may by-and-by prostrate them with inflammation of the lungs, or with acute rheumatism.

A few words are appropriate respecting two other matters seriously

affecting the health of potters, viz., irregular habits of life and intemperance. These directly damage the health and also diminish the powers of resistance of the system to the causes of disease.

In the category of irregular habits we include irregular meals, late hours and sensual excesses. But the abuse of intoxicating drinks stands foremost among the causes destructive of life and health. Yet it rarely stands alone, for generally the several irregular habits referred to are associated with it as consequences. Intoxicating drinks are directly injurious to the lungs when taken in such excess as to utterly load the blood with carbon, for the removal of this element is a principal business of the lungs, and consequently an overdose of it encumbers and embarrasses those organs. They also gorge the liver and damage digestion, with the further result of increasing the embarrassment of the lungs, for in the human body one organ or function is so bound up with another that if one member suffers all the other members suffer with it. You cannot with impunity sin against one organ of the body. You cannot drown your stomach with beer without paying for it in your lungs as well as elsewhere.

Who do medical men find to resist best the unfavorable conditions of his employment and generally live the longest? Why, the man who is prudent and temperate in all things. He may not win the applause of his fellow-workmen, and may be considered mean and wanting in mirth and good fellowship, but he has chosen the better part, and too frequently will witness with pain the break-down of his once jovial acquaintances, the wreck of their health and the premature closing of their career. A very large majority of those on the sick list among the potters of Trenton, with the various forms of potters' diseases, are or have been heavy drinkers of intoxicants.

One of the manufacturers remarked, "Keep drink away from the potters, and you would thereby keep sickness largely away from them."

Indiscretions and Faults in Habits and Modes of Living.

Diet.—Acknowledging as we must do that improper food is a fertile source of sickness with working people, it falls quite within the scope of this paper to say a few words about diet. Observation seems to justify the inference that with many people the diet chosen is that which costs them the least trouble in its preparation.

Cooks are very scarce in our workingmen's homes, and the inventive

capacities of our female potters in preparing savory meals are of the feeblest sort. To frizzle a bit of bacon with or without cheese, to brown and dry up over the fire a portion of butchers' meat and to boil a batch of potatoes is a comprehehsive summary of the culinary acquirements exercised by many housewives.

A home-prepared meal such as has been described is assuredly not appetizing, and it is not sufficiently nutritious, nor again is it easily digestible. It wants a great deal of liquid to wash it down, and the fluids chosen are commonly beer and tea, which, when abused, add still further to the toils and troubles of the unfortunate stomach. Besides, such insipid, routine meals call for some articles to give relish, and of these the best patronized are pickles and condiments. Then again, in most of our potteries the operatives eat their noonday meal in the factory. To eat food in any shop is a proceeding fraught with evil. It favors irregular and scratch meals, and hasty and slovenly feeding, with the consequence of damaged digestion and impaired nutrition and vigor. To take meals in shops, where the air is tainted with many breaths, and by the processes carried on, probably also unduly heated, and inevitably pervaded by more or less dust, stands to common sense as being detrimental to health. It likewise encourages idleness and idle gossip. Hence, it is far better for all work-people to quit their shops and get their meals outside. The exit to the open air, the diversion of the mind from the circumstances attaching to their labor, and the exercise enforced by the journey to their homes or elsewhere, are all conditions favorable to digestion. However, some of the workers live remote from the factories and say they are obliged to take the principal meal of the day in the shops.

In many of the large potteries in England a mess-room is attached, conveniently furnished, and having in some instances a kitchen annexed under the management of a trained cook. Such an arrangement presents great advantages to factory operatives, particularly by insuring to them hot, fresh and well-cooked food, with surrounding comforts, cleanliness and warmth.

In a few of the larger establishments here, or where several are located together, we might well wish to see carried out the plan indicated, but where this is impracticable, private adventure might supply the need by individual enterprise.

Sedentary Employment.—This source of ill health is in no wise peculiar to the potter's art. It obtains in the majority of our indus-

trial occupations, and doubtless operates more prejudicially in many of them than in the manufacture of pottery; for example, the milliner and dressmakers' shops. However, its effects among our artisans, particularly those engaged in the finishing departments, and when this is carried on in hot, ill-ventilated and dusty work-shops, are so obvious and so common that sedentary employment in this connection has a claim on our attention, and the diminution or prevention of its baneful results constitutes a worthy object of our study.

In the first place, its effects are more seen among female artisans, inasmuch as they represent a larger proportion of those engaged in sedentary pursuits, and for these obvious reasons the work in the finishing-shops is well adapted to females, and can be done by them at a cheaper rate than by men. It is a kind of work that requires very slight bodily labor, whilst it needs delicate manipulation, and, in the next place, it is in accord with the less active and in-door habits of women.

In what way, then, let us inquire, do sedentary employments damage health? Well, the human machine is furnished with appendages, or limbs, intended for active use. Locomotive organs are designed for locomotion, and it is not the office of our legs to serve for attachments to a chair or stool. That the limbs may be nourished, it is essential that the muscles moving them be kept in activity.

Moreover, that circulation and nutrition of the entire body be maintained, sufficient exercise is requisite. Sedentary occupation implies retarded or sluggish circulation, and languishing digestion and nutrition.

If the circulation be slow, respiration is also slow and less effective; the blood is less perfectly aërated or purified, and therefore every organ supplied by it is a sufferer. Hence, the production of stomach and liver disorders; of various local congestions, and of many general ailments. But the ill-effects of sedentary work are almost always made worse by accompanying conditions; *e. g.*, limited area of shop, imperfect ventilation, dust re-breathed, and heated air and noxious fumes from the processes of work.

Sedentary labor works still greater harm when it encourages resort to alcoholic drinks to stimulate appetite or flagging energy. Every drop taken is a drop too much, and will leave its mark in some damage to the body, especially to the liver and kidneys, and will, withal, augment the very discomforts for the relief of which it is

imbibed. The same may be said of pickles and condiments. Stomach and liver disorders rank foremost among the consequences of sedentary work, and they are always aggravated by improper food and drink, and neglect of out-door exercise. The consequences, therefore, of sedentary work, as witnessed every day by observing physicians, may be summed up as follows: Lack of energy, general debility, want of appetite, indigestion, defective blood-making, and, hence, bloodlessness or anæmia, sensitiveness to cold, constipation and a tendency to internal congestions, particularly about the lower parts of the body.

Unnecessary Exposure to Heat, Cold and Wet.—The result of such exposure other than inflammations of the chest or elsewhere, are witnessed in the shape of rheumatism and its allies. The pottery workmen most liable to rheumatic affections are *oven-men* and *kilnmen*, who are greatly exposed to heat and strong draughts. Standing at their work, with a fierce heat in front of them, their backs are at the same time blown upon by rapid currents of cold air, which produce mischievous chills, and too frequently, rheumatism therewith. And to make matters still worse, it is a custom with workmen to throw aside clothes, and in that way further favor the arrest of perspiration and the rapid cooling of the surface of their bodies. They indeed pay dearly for the greater coolness and freedom they gain, and it remains for them to learn that light woolen materials are not only defensive against cold, but against heat also.

Before quitting this subject of rheumatism, let me add that those who once suffer are very likely to suffer again; and, moreover, that to a certain extent they transmit a tendency to it in their offspring.

Further, it is the most common source of heart disease, with dropsy as its sequel. And lastly, it is a malady which finds a specially suitable soil where strong drinks, especially malt liquors, are indulged in, and where dissipation has sapped the health.

Sanitary Condition of Our Potteries.

The potteries are mostly built without any regard to healthfulness of location. Cheapness of site seems to have largely controlled the location of them. There has not been any under-draining of the grounds or their surroundings on which the potteries are erected. Many of the locations are extremely objectionable so far as healthful-

ness of location and surroundings are concerned. One of them, particularly, is built in the midst of the Swamp, so called, one of the filthiest and most unsanitary parts of the city. The health of the proprietors as well as those employed by them has been seriously damaged by the unhealthy surroundings of this pottery.

Most of the factories have been recently built, and are a great improvement over the old ones. They are all said to be far superior in a sanitary view, to most of the potteries in England. The lighting and ventilation, however, of many of them here might be greatly improved. The portions of the buildings most neglected as to light, are the basements and stairways. There is absolutely no system of ventilation, and what has been attempted is very imperfect.

In very many of the potteries the windows are not hung, and cannot, therefore, be pulled down from the top. This would not be necessary if ventilators were placed above the windows. Indefinite improvements in the direction of cleanliness, and the supply of pure and dustless air to them, are possible.

Whitewashing is not done as often or as thoroughly as it should be. Some have not been whitewashed since built, and as a result dust of all kinds has accumulated on walls and ceilings. Draughts of air blow it about, and of course it is inhaled by the workmen. The shops should be whitewashed at least once a year—better twice.

Water-Closets.

The water-closet accommodations in connection with our potteries are faulty, and many of them were in a filthy condition, as well as remote from the workshops. As a consequence, the work-people are compelled to go a considerable distance from the hot work-shops in the open air, and exposed to storms of rain or snow in winter.

Many of the operatives have contracted severe and fatal colds in this way. This condition of things should be remedied at once. Urinals, at least, should be placed in every work-shop, or contiguous to it, under shelter, so that the workmen would not be obliged to expose themselves, as they now do, whenever they attend to the ordinary calls of nature.

Only one pottery was found with urinals attached to the workshops.

Elevators.

In most of the potteries elevators are in use, but in some the clay is still carried up on the heads of boys and men from the slip-house. This is heavy, straining work, especially when done by boys, and many of them are overworked in this way.

Elevators should be provided in every pottery. Potters, as a class, have rarely room for complaint of overwork. The system prevailing among them is that of piece-work, and therefore the duration of their labor is largely within their own power.

Overwork is a widely-recognized and much-talked-of cause of illness, yet it finds but few victims among those engaged in our potteries.

What preventive measures can be taken against the evils already described?

Prevention.

One other lesson before we leave this subject, on the ills flowing from the inhalation of dust. Keep it out of the lungs, by all means. But, besides this, use every precaution against catching cold, for a cold on the chest, affecting the bronchial tubes, or the lung tissue itself, lends increased activity to the dust that pervades the lungs, and brings about that solidification of those organs which is the chief characteristic of potter's consumption, and the immediate cause of the asthma from which they so greatly suffer.

The composition of the glaze is such that it dries with great rapidity and forms quickly an impalpable powder, most readily detached and diffused through the air. Hence, in a dippers'-shop the work-people themselves, every part of the apartment and all articles about are powdered over white, and when the rays of the sun dart through the air of the shop the fine dust is rendered perceptible to the eye. Now, there are dippers and dippers. There are workmen who carry on the trade for many years, suffering nothing beyond a little colic or constipation, and, it may happen, some derangements of digestion.

On the other hand, there are others who fail within a few months after beginning their employment in a dipping-house. Why is this? Well, it must be granted that some persons are more susceptible to lead-poisoning than others, and, again, that some glazes are more poisonous than others. In one pottery not a single case of lead-

poisoning had occurred since the old dippers and potters that came over from England had died. It is also said that the English potters use more lead in their glazes than is used by the manufacturers here. Nevertheless, the principal explanation of the fact is that some men are much cleaner in their work than others, that they use greater precautions, and that they are altogether more considerate of their health.

The primary preventives of lead-poisoning resolve themselves, therefore, into the observance of cleanliness of person, of dress and of the shop. The work-rooms must be well ventilated; excessive heat avoided, because this favors the production and diffusion of dust and renders the perspiring, thirsty workman a readier prey to its absorption. Moreover, to keep down the dust, the shops should be freely sprinkled with water and kept scrupulously clean.

Respirators.

Among the most effective measures against the inhalation of dust is the wearing of respirators so as to cover both the mouth and nose. To be protective they must cover both. No elaborate mechanism is necessary. A piece of wool possesses a marvelous power in filtering the air passing through it from all solid particles.

But as it is not easy or agreeable to plug the mouth and nostrils with wool, we may, as suggested, with little loss of efficiency, substitute some woolen material, and none is more suitable than crape. Of this two or three folds may be attached to a rude frame of bonnet wire, bent across the nose and kept in position by a piece of elastic cord passing around the head over the ears. The wife, or daughter, or sister of any one could soon make such a respirator. This simple instrument, as already stated, would keep the lungs and stomach free from dust, whether of lead, or of clay, or of coal. Some object to a respirator on account of their appearance. But surely health is more valuable than mere appearance or the figure we make before our fellow-men. Another objection is that respirators somewhat embarrass the breathing and keep moisture disagreeably about the mouth. There is some force in this, but it should not weigh against the advantages of the respirator and should count as naught.

There is a respirator known as the Hurd Automatic Respirator, of East Saginaw, Michigan, that is provided with valves and does away with all serious and reasonable objection to the use of respirators.

Touching this question, there is yet another point that must be mentioned, viz., the employment of children where lead is used, and particularly in dipping-rooms. Experience has shown that they become victims to the poison more readily than adults. But where such work is assigned to them their parents or their employers should certainly be required to provide protective means against the injuries they are exposed to, and not, as too frequently happens, put these boys and girls to work in most unsuitable clothes, often ragged and besmeared and powdered over with the poisonous glaze, in the absence of aprons and "slops" to protect them. Enough has been said, perhaps, of cleanliness in person, and dress, and work as a safeguard against dust, whether arising from clay or from glazes. But there are auxiliary measures to be taken. What other precautions should be taken, particularly where lead is used? In the first place, as already hinted at, the clothes should be protected when at work by slops and very ample aprons, and in the case of girls and women their long hair should be covered.

All unnecessary flimsy and fluffy articles of dress should be laid aside when at work. Outer garments, such as cloaks, coats and shawls, should be hung up in some apartment outside the work-shop, whilst the shaking and brushing of the protective coverings should be done in the open air, and in such a manner that the dust may be blown from the person. Great cleanliness of the hands and face should be observed. To secure this a lavatory or some sort of washing convenience ought to be found in every factory and within the reach of every work-shop, and for those using lead, nail-brushes and soap.

Flint and Spar Mills.

There are two of these in the city, in which over fifty men are employed. Those employed in these mills are great sufferers from dust, and but few of the men remain at the work longer than two years. The flint is first calcined in kilns and then ground in large cylinders with pebbles. The feldspar is first placed under large stones, or crushers as they are called, and is not calcined. After that, it is placed in the cylinders and ground into a fine state. The dust from this is inhaled by the workmen, and they very soon become asthmatical. In one of the mills they have a fan and dust-pipe, which

carry away some of the dust when the cylinders are opened and the screening process goes on. All of the men are compelled to wear respirators, but with all the precautions used the men soon give out.

Conclusions.

Having now given a tolerably-complete review of those unfavorable conditions of labor which, whether accidental or unavoidable, prevail among those engaged in the manufacture of china and earthenware, it must be admitted that the occupation of potters is, by no means, a healthy one.

In making these investigations the writer has had an unusually wide field of observation, owing to a long residence in Trenton (over twenty-three years) and in attendance on many families of the working potters. The information and clinical knowledge thus obtained, as well as a personal inspection of all the potteries in Trenton and vicinity, and careful inquiries made at the time, have impressed themselves on the mind of the writer as laden with issues of the utmost importance to the health and well-being of those engaged in this industry.

The subject has been treated in a critical and practical manner. All the facts as to the perils to health, so far as could be obtained, have been pointed out.

We have departed from the usual custom of giving death-rate and table of statistics, as we have not accurate lists reaching over sufficiently-long periods. A long list of those sick and suffering with the various diseases peculiar to potters, as well as the results of several post-mortems, had been collected and prepared for publication, but we await the accumulation of larger numbers.

The question is a living one, and what the public, those most interested, desire to know, is the cause and prevention of disease among this skillful class of artisans.

To extension of machinery we may also fairly look for amelioration in the various departments of the potters' art, and equally also for the means of upholding our position as manufacturers against foreign rivalry. Nay, more, even with regard to the latter desideratum, the healthfulness of our working potters cannot serve otherwise than as a valuable contributory factor.

In all trades, the minds of those engaged in them are prone to get

so engrossed by daily detail, and their methods to acquire so routine a character, that defects in their mode of work pass unnoticed—a kind of indifference or dislike to innovations steals over them, and there ensues a perpetuation of erroneous practices and contracted ideas and aims, inimical to health, progress and prosperity. In such instances, an unprejudiced outsider may spy out prevailing defects, and, though uninitiated in the mysteries of the trade, may render signal service to it by pointing in the direction of reform, and by suggesting modes of proceeding or courses of action calculated to benefit those engaged in the business. It is with this sole object in view that this paper has been written, and if it accomplishes this result the writer will be satisfied.

Recapitulation.

1. That dust, and the liability to inhale it, is the principal cause of potters' asthma and potters' consumption; that the greatest number of sufferers from the above-named diseases occurs among "china scourers."

2. The greatest sufferers from lead-poisoning are dippers, and those assisting them—glost-placers, mixers of colors, ground-layers, majolica and other painters, and those who "fettle" ware after it is dipped.

Dippers rank first, both in respect of numbers attacked and of the severity of attacks; ground-layers are a small body of work-people, but in proportion to their numbers suffer largely; majolica-painting is mostly done by women and girls, and they are sufferers from lead in an undue ratio.

Again, biscuit painters, who use glaze mixed with gum-water or some simple solvent, become affected, as do enamel painters in still rarer instances. Happily for all who work in lead the skin affords a most effective protection against its absorption, consequently very little enters the system through the cutaneous surface.

The lead-poison must find its way principally through channels whereby it will reach absorbent surfaces. These channels exist in the nose and mouth, which conduct it to the lungs and stomach.

3. That the pottery workmen most liable to rheumatic affections are ovenmen and kilnmen, who are greatly exposed to heat and strong draughts. They also suffer much from colds contracted from the sudden checking of the perspiration, which often terminates in acute inflammations of the chest.

4. That those engaged in sedentary occupations suffer most from disorders of the digestive organs, liver and stomach, followed by general debility, defective blood-making, and, hence, bloodlessness, sensitiveness to cold, constipation and a tendency to internal congestions, particularly about the lower parts of the body.

5. The auxiliary causes to be mentioned are neglect of cleanliness in work, in shops, in dress and in personal habits, inattention to ventilation and to the heat and moisture of the workshop, intemperance and irregular living. My observation satisfies me that a large majority of workers in potteries do not remain continuously at the occupation for more than from fifteen to twenty years, and that careful attention to the particulars noted would increase the working-period.

Finally, that the removal of the exciting cause or causes is the only rational means of preventing or interrupting the diseases of potters.

There is no doubt, however, from the reliable information gathered from those who have lived and worked in the potteries of the Old World, as well as from statistics, that pottery operatives in this country are in better health and longer lived than in England. Our climate is drier; the work-shops are mostly new, and more work is done by machinery.

TYPHOID FEVER AT MOUNT HOLLY.

BY E. M. HUNT, M.D.

Early in June the Secretary of the State Board of Health was notified by Dr. R. H. Parsons, of the Local Health Board of Northampton township, and by Dr. Parry, of Mount Holly, that a somewhat unusual amount of sickness was occurring in Mount Holly; that some of the cases were of doubtful diagnosis as between remittent and typhoid fever, but that some of them had all the symptoms of pronounced typhoid fever. In response to this information, on June 6th the Secretary of the Board visited the town and had conference with five or six of its physicians. I was able at that time to get some information as to about sixteen cases, although in some of these the full type of the fever was not declared. There were, however, in some of the cases, the usual distinct symptoms of typhoid fever, so as to leave no doubt in my own mind or in that of the others with whom I consulted, that there was an unusual tendency to this form of fever. We were not delayed in accumulating evidence from eruptions, hemorrhages, &c., as to the full type of the disease. These first cases were carefully inquired into. There was no common source of milk-supply. There was no relation to any single well of water. The cases could not be grouped in any satisfactory way. At least five well-marked cases had occurred before June 1st. There had been one case of typhoid fever some time before, but I failed to find any connection between it and the cases occurring in other parts of the town. The fever did not seem to be localized in any one part of the city. It was natural to look to some general operating cause.

I had especial occasion to make inquiry as to the condition of the water-supply, because I was aware that it was taken from a stream that passed through the village of Smithville, where I knew there had been typhoid fever the summer before. Of this I had received intelligence through Dr. Thornton, of Moorestown, who very wisely had notified me that he had a patient with the fever, whom he was satisfied

contracted it there. The place was at once visited that summer, and, under the direction of this Board, the fact corroborated, as well as some conditions found which were unsanitary. These were remedied, and no further cases of fever were reported to us. Dr. Parry was fully familiar with the facts, as he had visited the place on behalf of the State Board this previous year.

Having informed myself of all the facts as to Mount Holly, in company with Dr. R. H. Parsons, of the Board of Health, I went to Smithville. I readily found, from general information and afterward from the physician attending cases there, that there was typhoid fever in the vicinity. I visited the boarding-house where there was at that time one case, it being the wife of the gentleman in charge. She was too sick to be seen, and said to be past recovery, but we were able to have an interview with her husband. We ascertained that she had been sick for about three weeks; that the discharges had been thrown into the house-closet, from which they directly passed by a short pipe into Rancocas creek. The discharges were not received into any disinfecting solution and, although it was said that some disinfectant had been used in the closet, a full inquiry showed that so little of any disinfectant had been purchased or used that, practically, all the material was passing daily into the stream in its natural state. We had the further evidence that there were other closet connections to the stream, and that in general, after heavy rains, other houses on the hill had their contents washed away toward the stream.

There was also, as since discovered, a place near the stream where much fæcal matter accumulated until washed out by rains. There was no very cheerful disposition to aid us to a knowledge of all of the facts, but most of them were ascertained.

The physicians in charge had carefully ordered disinfection, but the orders had not been carried out. Conversation and correspondence with the physician in attendance gave me the following additional facts: The case inquired into and two others in the village of Smithville, began between May 2d and 9th. Two of the cases were in this house. The other case, in a farm-house near by, was taken sick May 9th and died of intestinal hemorrhage May 23d. The two cases in the boarding-house were confined to their beds six and eight weeks respectively and recovered. The discharges were passed daily into Rancocas creek, up to June 7th. While there were some scattered cases, this was the earliest group of cases. Dr. Hollingshead, of Pemberton, attended twenty-three cases outside of Smithville. Of

these, two were young men who worked at Smithville, and one a seamstress, who had been at Smithville a week just prior to the first cases. There were three cases in one family, the son being employed at Smithville, although himself not down with the disease.

Six of the twenty-three cases occurred within 1,000 feet of Rancocas creek. Thus, an investigation of cases in Mount Holly, as also some corroborating facts, seemed to show this to be the head-center of the cases. Afterward the cases connected with Smithville, but sick away from there, could easily be the centers for others, and our inquiry therefore made it certain:

I. That there were cases of typhoid fever in Mount Holly.

II. That these cases seemed to have occurred in various parts of the town and not to be connected with a localized cause on any premises.

III. It was certain that Rancocas creek, from which the water-supply of Mount Holly was derived, was receiving at a point about three miles above the in-take, typhoid alvine discharges in abundance, which would have easy conveyance to the crib from which the drinking-water was derived.

Under these circumstances, I at once called together such members of the Local Board as I could command and stated the facts in evidence, and with Dr. Parsons and the Board advised that all water used for drinkng in Mount Holly be boiled. Dr. Parsons took immediate opportunity to promulgate this advice. The physician in charge at Smithville was immediately communicated with and all discharges properly dealt with, and under no circumstances placed in the stream. It is believed that after June 7th, pollution of the water-supply from Smithville was interrupted, and so far as typhoid fever patients were concerned, probably discontinued. From this time the physician of the Local Board, the principal practitioners of Mount Holly, and the Secretary of the State Board, exercised all authority at their command and gave direction as to necessary precautions.

Cases of the fever multiplied quite rapidly from the 1st of June to the 28th, or for about three weeks after this advice was urged.

In order to show the temperature and the drought and sudden rainfall which are believed to have influenced the time of outbreak at Mount Holly, we give the careful meteorological record of T. J. Beans, at Moorestown, for May, June and July, 1887. This needs to be noted as bearing upon the times of outbreak or increase:

MONTHS, 1887.	TEMPERATURE.						
	Mean.	Normal.	Excess or Deficiency.	Max.	Date.	Min.	Date.
May	63.9	60.8	+3.1	86.0	{ 20 21 }	46.0	15
June	68.6	70.9	-2.3	91.5	17	56.0	11
July	76.8	75.7	+1.1	98.0	16	68.0	{ 11 12 }

MONTHS, 1887.	PRECIPITATION (Rain and Melted Snow).																
	Total Amount.	Normal.	Excess or Deficiency.	Dates on which Rain or Snow fell, and Amounts.													
May	1.89	3.67	-1.78	Date.	6	7	8	9	21	25	26	27	28	29			
				Am't.	.01	.50	.96	.01	.01	.09	.02	.10	.12	.07			
June	6.20	3.82	+2.38	Date.	1	2	3	5	6	7	10	17	18	19	22	23	24
				Am't.	1.83	.04	.42	.12	.03	.43	.27	.07	.08	.13	.07	1.70	.96
July	6.59	4.25	+2.07	Date.	5	6	9	10	16	19	21	22	23	24	25	26	27
				Am't.	.56	.04	.02	.02	.30	.06	.18	.96	.53	1.77	.57	.61	.67

I have had some difficulty in obtaining precise water-supply data as to the beginning period of all cases, but have not been able to find any cases occurring after June in those who drank only boiled water, unless it be the case of one person who nursed another who died of the disease.

In all, there are reported to us about 100 cases in Mount Holly and vicinity. I have particulars as to about fifty. The whole number of deaths returned of typhoid fever was six. We have good reason to believe that many of the cases regarded as remittent were cases of mild typhoid fever, and that up to the time of my first visit, June 6th, several more had become affected with fever and diarrhœa from a common source. Also a few cases showed dysenteric type and were

called dysentery. We also have some evidence of the pollution of the Rancocas creek by typhoid fever evacuations above Smithville as late as July 27th.

The Secretary of the Board and Special Inspectors visited Mount Holly as often as seemed necessary. Dr. Parsons and the Secretary were in correspondence and the files of the newspapers of the town will show that there was no concealment of the peril or of the proper means of security.

Up to this time all that was necessary to assert was that the facts in evidence showed that the Mount Holly water-supply had been subjected to a special source of pollution in that the discharges of typhoid fever had been freely deposited in it, and therefore due precaution required its boiling for a time after this pollution had ceased. Since cases of the fever had been scattered over the town and since wells were in use by some households which were near to cesspools, it was also advised that all well-water be boiled until the chief peril seemed past.

While for the time all questions as to the general character of the Mount Holly water-supply were properly in abeyance to the one fact of special contamination, it could not but occur that questions would be raised as to the general character of the supply independent of this special peril.

This led to many discussions, opinions, dissertations and examinations, official, individual, personal and voluntary.

They seemed to supersede the necessity on the part of the Secretary of his offering his services in this particular direction, and because of the partisan feeling prevailing seemed to render it proper that this Board should await any further demand of the local Board for information as to what was to be done to make certain a pure water-supply when the special pollution had ceased and when the precaution of boiling could not so well be maintained as amid the actual prevalence of disease.

The local Board promptly informed itself of some errors as to the locality of the in-take, the times of drawing the supply, the condition of the mains, of dead ends and of the reservoir, and secured attention to these on the part of the company. The company, being a private water company, was not so directly under control as if it had been a public ownership. The experience of the Board certainly revealed some neglects that ought not to occur as to a public water-supply and

showed how necessary it is to have a local Board of Health that will make from time to time technical examinations. It is not the first case that has revealed the over-confidence of men of good intent in their own constructions and methods, merely because they have no skilled knowledge and so believe that they are in possession of all the latest improvements or have excelled them.

The condition of what in general we will call the water-works, the dryness of the season before the last of May, the heavy rains following, the amount of vegetable organic matter naturally in the stream, and the addition thereto above the in-take of quantities of typhoid excreta, seem to afford the most natural explanation of this outbreak of typhoid fever at Mount Holly. That there were an unusual number of cases in rural towns adjacent is true, but in most of these cases connection can be traced with Mount Holly or with those who worked at or near Smithville. Where it cannot be there is no other center of communication so likely.

In July, the Secretary of the Board issued the following circular, which was freely distributed:

CIRCULAR.

"The Secretary of the State Board of Health, after consultation with the local Board of Health, begs leave to present the following brief circular letter to the citizens of Mount Holly. It cannot but be recognized that since April 1st there has been an unusual amount of sickness in Mount Holly. From the first, many of the cases of fever have been of a remittent type, without any other distinct symptoms. Several cases of typhoid fever have occurred, although, outside of the city, the number has been greatly overstated. There has also been more cases of bowel affection than usual. More recently several cases of dysentery have occurred. Since about the first of June, when the State Board was made aware of an increase of sickness, we have been in frequent consultation or correspondence with members of the local Board. It had much reason before this to complain of the apathy of the citizens of Mount Holly as to sanitary conditions. The State Board long before had very clearly and forcibly expressed its sense of this want of care. The Board, being a township Board, was less independent of public opinion, and had not been sustained in efforts to secure active and efficient administration. Since the beginning of the sickness the local Board has had better support, and has sought to remedy existing evils.

"At our first examination two things were apparent—first, that there was not proper precaution as to the location of cesspools and the

disposal of household wastes, and that there was not any system of sanitary inspection adequate to the proper sanitary guard of such a town. Also, that where wells were used, some of them were not located so as to promise a safe drinking-water.

"A still more serious fact was revealed. The water-supply of the city was receiving freely the discharges of typhoid fever patients about two miles above the reservoir in-take. In heavy rains the wash from several out-houses also entered the stream. The stream itself always abounds in a high amount of vegetable matter, and is not one to which other matters of any kind can be added without great risk. It was on these grounds that the advice was at once given that no water from this source be used without it had first been boiled. Further investigation showed that there was unnecessary foulness at the point of in-take, that flushing of pipes was neglected, and that the condition of the reservoir was not what it should be. While prompt attention was given to some of these defects, there is still room for improvement. Chemical examinations have shown the water-supply still in an unsatisfactory condition.

"While it is not the design of this circular to attempt to decide whether this source of potable water will have to be abandoned, it is the design to insist upon it that it shall not be used without boiling until the local Board shall so authorize. The tendency to sickness, the recent heavy rains and the overflow of the low lands lead us to fear serious consequences from continued sickness, unless every precaution is used. While the number of typhoid cases has steadily diminished since the last of June, other forms of sickness have not, and several cases of dysentery have occurred.

"We believe it incumbent upon every citizen to take unusual precautions against sickness, and to aid in securing the most exact cleanliness of all surroundings. Where there is sickness, disinfectants should be freely used in vessels that receive discharges. A tablespoonful of chloride of lime in a pint of water answers every purpose. This should also be used in any sinks or house-closets connecting with cesspools.

"In all typhoid or dysentery cases, if possible, the excretions should be buried. This Board has arranged with the local Board for a prompt and thorough house-to-house inspection of the town. It is believed that if all aid the local Board, and follow any additional directions they may see fit to give, there will soon be a diminution of sickness and a speedy return to the usual healthfulness of this locality."

So much for the probable origin of the Mount Holly outbreak of typhoid fever. The table, showing the meteorological conditions, kindly furnished by Mr. T. J. Beans, of Moorestown, exhibits how the alternate dryness and wetness favored the outbreak.

As to the Rancocas creek, as a source of water-supply for Mount

Holly, there is need of careful inquiry. Before this occurrence, it may be said to have had a good reputation. It is time that those who study water-supplies regard any of the streams flowing through peaty soils, or abounding in vegetable matters, as sources which are more *liable* to deterioration than others—although it is generally not in their relation to sudden or deadly diseases. Strangers are often affected by such waters, and young persons may have some diarrhœal disturbance. Other supplies are generally desirable, although these are not always to be condemned. A few weeks after the special contamination had ceased, two chemists, Prof. Leeds, Ph.D., of Stevens Institute, Hoboken, and Shippen Wallace, Ph.D., of Burlington, made examinations of the water-supply. The analysis of Prof. Leeds presented chemical and biological conditions, and that of S. Wallace, the chemical only. The first is to be found in the Philadelphia *Medical News* of September 3d, 1887, and the latter was a report made to the Mount Holly company, and contained in the Mount Holly *Journal* of July 25th, 1887.

The respective chemical analyses were made July 7th and July 25th, and are as follows:

I. ABOVE SMITHVILLE.

	Parts per 100,000.	Grains per Gallon.
Free ammonia	0.002	0.0012
Albuminoid ammonia	0.015	0.0087
Oxygen required to oxidize organic matters	1.27	0.70
Chlorine	0.45	0.26
Hardness	3.10	1.80
Total solids	6.30	3.67
Mineral matters	3.30	1.92
Organic and volatile matters	3.00	1.75

II. PUMPING STATION AT MOUNT HOLLY.

	Parts per 100,000.	Grains per Gallon.
Free ammonia	0.006	0.0035
Albuminoid ammonia	0.0155	0.009
Oxygen required to oxidize organic matters	1.10	0.64
Chlorine	0.55	0.32
Hardness	2.20	1.80
Total solids	6.20	3.60
Mineral matters	3.30	1.92
Organic and volatile matters	2.90	1.68

The chemical analysis of the creek-water made for the water company by Shippen Wallace, of Burlington, resulted as follows:

"JULY 25th, 1887.

"*To the Mount Holly Water Company:*

"GENTLEMEN—The following is my report on my analyses of the samples of water received from you:

Total solids, parts per 100,000			5.4
Loss on ignition,	"	"	3.4
Chlorine,	"	"	0.10
Free ammonia,	"	"	0.005
Albuminoid ammonia,	"		0.032

"The small amount of 'chlorine' would indicate that the water is not contaminated with sewage; but that it is contaminated with organic matter, there is no doubt. This is shown by the great 'loss on ignition,' and while this loss is not always due entirely to the destruction of organic matter, in this particular instance I think it is. It is also shown by the large amount of 'albuminoid ammonia,' which exceeds the limit generally accepted, and which figure, taken alone and with no knowledge of the origin of the water, would unquestionably condemn it."

Prof. Leeds concludes from his analysis that the waters of the creek were at the date of July 9th polluted by sewage at or below Smithville, but not above it. The Professor concludes that by "aëration under pressure, followed by filtration," this water could be "rendered pure, colorless and palatable."

Dr. Wallace, on the other hand, from his analysis, concludes that the "contamination of the water has been caused by decayed *vegetable* matter, derived from sources of the stream, and not from any sewage or animal matter." The outbreak had occurred several weeks before, and early as June 6th had been authenticated as typhoid fever, and as typhoid evacuations were proven to have been received into the water-supply, this contamination had probably ceased over a month before the chemical examinations were made, and new cases ceased mostly to occur after June. We submit that the explanation of this particular outbreak is to be found in the specific contamination rather than in the general conditions, but confirmatory of pollution of some kind. Since, however, after the special pollutions had ceased, these competent authorities claim the water of the Rancocas to be unfit for drinking

purposes, either it should be made fit or be abandoned, or the testimony of the experts overthrown.

For, whether we take the view of Prof. Wallace, that "the contamination of the water," as he found it July 25th, "has been caused by decayed *vegetable* matter, derived from sources of the stream, and not from any sewage or animal matter, and sickness may have arisen caused by the decomposition of this vegetable matter," or the view of Prof. Leeds, that, in addition to this vegetable matter, the stream contains "animal matter in the nature of sewage," it is plain that there is sufficient gravity in either of the statements to make the people uncertain as to the quality of the water-supply.

As a result of further examinations and inquiries made in October last, the following note was addressed to the Local Boards of Health of the townships in which Mount Holly and Smithville are located, as also to the water company:

"STATE BOARD OF HEALTH,
"TRENTON, N. J., Nov. 1st, 1887.

"*To the Local Boards of Health of Easthampton and Northampton townships, Burlington county, and to the company supplying Mount Holly with water:*

"GENTLEMEN—I have taken opportunity since the typhoid fever has subsided in Mount Holly to acquaint this Board still further with the sources of pollution to which Rancocas creek has been exposed and to some of which it is still exposed. They involve such risk to the health of these townships as makes it the imperative duty of all concerned not only to apply the general health laws of the State as far as available, but the special law as to the pollution of streams used for a public water-supply. This power rests with these Boards and with the water company, as also with every citizen of these townships. It does not rest with members of this Board not residing in the district, nor has it been conferred upon the State Board by law. But it is nevertheless an imperative duty for us to reiterate these facts. While we are not called upon herein to pronounce judgment as to the possibilites of a pure water-supply from Rancocas creek, we would be recreant to our duty did we not again warn you as to sources of pollution still existing.

"On behalf of this Board,

"Respectfully yours."

We are glad recently to hear that the company are taking active measures to secure an assured purity. This supply will need the careful oversight of all those interested, but we cannot but believe

that every effort will be made to provide a supply which chemical and medical and all evidence derived from experience will alike confirm as safe and wholesome.

Incidental to the occurrence of typhoid fever at Smithville, Mount Holly and about Pemberton, we were led to some correspondence as to the tendency to fevers and epidemics in other parts of Burlington county. This was the more important, as it was occasionally asserted that fevers prevailed frequently in the county. This was not substantiated by our inquiries.

There was an outbreak of typhoid fever at St. Mary's Hall, Burlington, in the early winter of 1874. The first case occurred on the 4th of December, and before the 20th of the month there were eighty cases. Sixty remained at the school and recovered. Twenty went home, and of these seven died. The outbreak seemed clearly traceable to a polluted water-supply. The drinking-water was taken from a well or cistern into which it was pumped from the Delaware river. Near the well was a large cesspool, of which the brick and cement had crumbled so as to allow a leakage into the water-supply. Those who drank tea and coffee only, escaped the sickness. Here, therefore, the cause was entirely local. Four years ago there were fifty cases "about" Medford, but of a mild type. There have been occasional localized outbreaks of continued fevers of some form and of dysentery. It is quite noticeable that in this county, pumps or cisterns are frequently located in the wash-house or kitchen-shed, where they are too apt to be exposed to sources of contamination. We have visited many farm-houses at which the care of the drinking-water could be much improved. The same is true in several of the small villages and towns.

ABSTRACTS FROM THE

PAPERS AND DISCUSSIONS OF THE NEW JERSEY SANITARY ASSOCIATION,

SESSION OF 1887.

BY D. C. ENGLISH, M.D.

The thirteenth annual meeting of the New Jersey Sanitary Association was held in the Assembly Room, at the State House, Trenton, commencing Friday morning, October 28th, at 10:45 o'clock. The President, William K. Newton, M.D., of Paterson, in the chair. After the Secretary's Report and the transaction of other items of business, Dr. J. S. Simpson, of Orange, read the first paper on "The Prevention of the Spread of Contagious Diseases through the Schools." After alluding to the difficulty which sanitarians have in prosecuting their work, owing to the ignorance of the people or pure selfishness, he referred to the good the physician may do by taking advantage of every opportunity offered for the instruction of the laity in the laws pertaining to general hygiene and public health. For as the public becomes enlightened they will willingly give us their aid instead of offering resistance. He said that the vital statistics of the State for the past year show that about one death in every nine is due to some contagious disease, and as one death in every eleven is an individual between five and twenty years of age, many of these must be school children. He referred to the great importance, from the data given, of preventing the development of contagious diseases in the schools, and of thoroughly protecting the scholars from contagion after any of these diseases have once developed. At some length the paper described the characteristics of small-pox, chicken-pox, scarlet fever and measles, so common among children. All of them, he claimed, are contagious, and therefore may be carried from one person to another by individuals who have been exposed to the

contagion, even though in good health themselves. The poison of the three is extremely tenacious and may remain virulent for a very long time. The speaker thought it was necessary during every outbreak of epidemic of any of this class of diseases that all school children should be carefully watched for any premonitory symptoms sufficiently significant to justify their exclusion from school. The child should not be allowed to return until every symptom of the disease has disappeared and desquamation or dessiccation has been entirely completed. No clothing worn during the sickness should be allowed in the school-house, and all persons exposed to the disease or living in a house where it exists should be forbidden to enter the school until all the cases in the house have fully recovered. The physician in attendance should see that such houses are thoroughly fumigated and disinfected.

As to chicken-pox, the child need only be excluded from school while suffering from it, but in small-pox, vaccination should be required. All children should be vaccinated carefully before admitted to school, as the school laws require. He recommended re-vaccination every five years, and believed it would be well if it were done during every epidemic of the disease.

Diphtheria the speaker considered the most dangerous of all diseases to children. Typhoid fever, whooping-cough and mumps are all diseases that need much care in handling. They are all contagious but typhoid fever. The morbific elements of the latter seem to be innocuous in the fresh state, and only become virulent when allowed to develop into activity by feeding on excreta under favorable conditions. If any of these get into cesspools or sewers they may cause disease when the latter are cleaned out unless the matter is thoroughly disinfected before disposal.

When typhoid fever or diphtheria arises in a school-building, the surroundings, drainage and drinking-water should be most carefully examined and all defects and impurities remedied. He did not believe it necessary to exclude from school, children residing in houses in which typhoid fever cases existed if they themselves were unaffected by the disease. He believed the same rule applied to mumps and whooping-cough, while in diphtheria every child in the home where it existed should be excluded. He also spoke of scholars affected with cutaneous contagious diseases as favus, tinea, scabies and pediculosis; that no scholar should be allowed to attend school while suffering from either of these diseases.

The doctor, in conclusion, advised that dry and elevated sites should be selected for school-houses, where the children may have plenty of fresh air and sunlight; that the buildings should be so constructed as to give large school-rooms, perfect drainage and ventilation, ample play-grounds and plenty of pure drinking-water. This would place the scholars in the best condition to resist the causative influences of disease. Every school-house should be thoroughly inspected in regard to its sanitary surroundings at least once a year and during every epidemic.

Dr. E. M. Hunt, after expressing his appreciation of the paper, said:

"I regard the prevention of the spread of contagious diseases through the schools as involving almost the entire subject of the spread of such diseases, since children are most likely to be affected by them, are most frequently the carriers of them and because their association in schools exposes more persons and families to them than occurs through any other instrumentality. I specify, among others, the following means of prevention:

"All school buildings should have thorough housekeeping. This means that, at the beginning of each vacation, there should be a complete cleansing, under the direction of a committee of ladies; that the building should be looked over thoroughly before the opening of school; that there should be flushing with air, after the close of school each day, and that in many schools there should be dusting, cleansing and whitewashing on one or more Saturdays during a term.

"The teacher should have the name of parents, and, in cases of cities, the numbers of houses represented by pupils. In case any house has in it a case of contagious disease, the physician should be seen by a Trustee or Clerk, and his advice taken as to prohibiting attendance therefrom. If there is any epidemic, the Clerk should visit each house and prohibit attendance where he found cases. We do not favor the closing of schools because of a very few cases, as it is an unnecessary interruption and the idle children are about as apt to congregate as they do in school.

"In case of small-pox, there should be more systematic inquiry as to vaccination, and Trustees should enforce it, without waiting for cases of small-pox to occur.

"Care of cloak-rooms is very important in its relation to contagious diseases. As diphtheria has come into such prominence as a communicable disease, and, as the breath is so much the vehicle of disease, any case of sore throat in a school should at once be noticed and the child allowed to go home. The use of a little borax or potassium chloride, as a gargle, is always a safe precaution.

"It is now known that the sputa of diphtheria, whooping-cough,

&c., often conveys these diseases. Children should never be allowed to spit on the floor in a school-room."

The discussion of the paper was further participated in by Shippen Wallace, Ph.D., of Burlington; Dr. J. P. Davis, of Milltown; Drs. E. M. Hunt and H. G. Wetherill, of Trenton, and James Owen, C. E., of Montclair. The following were some of the points: Children are largely the conveyancers of these contagious diseases. Methods of isolation as one of the most difficult points. Immediate notification to the Inspector as of the greatest importance. Teachers should have rolls of their scholars, where there homes are, and they should ascertain why any pupil is absent from school. Importance of enforced cleanliness, not only in the home but also in the school-room, cloak-room, &c. Spitting about the rooms should be prohibited—spittoons being provided. Contagious ophthalmia was referred to. Tuberculosis is spread through sputa in certain conditions. Instances were given where great difficulty occurred from the ignorance of some physicians, one declaring that diphtheria was not contagious, another that scarlet fever was not contagious. Ignorance of some School Trustees was also cited as one of the difficulties encountered.

POLLUTION OF STREAMS.

E. S. Atwater, counselor-at-law, of Elizabeth, next read a paper on "The Legal Aspects of the Question of the Pollution of Streams." (The paper is to be found, page 37 of this report.)

The discussion of this paper was opened by Dr. E. M. Hunt, Secretary of the State Board of Health. He called attention to the importance of this subject, referring to the experience of the danger from water-contamination in Rahway, Elizabeth and Long Branch during previous years. We should make our aqueduct companies carefully examine from time to time the sources of supply of drinking-water, the reservoirs, pipes, the contaminations along the banks of streams, especially about the point of in-take.

Dr. Gauntt, of Burlington, spoke of the interest in this subject as compared with twenty-five years ago, and dwelt on the need of even greater care in consequence of the increased sources of contamination. He spoke of the water-supply of Philadelphia as urgently needing attention, and closed by expressing the hope that Trenton would not discharge its sewage into the Delaware.

AFTERNOON SESSION.

At 2:30 o'clock the meeting was called to order, and the President announced the next subject, on the "Methods of Sewage Disposal in New Jersey," and introduced C. Phillips Bassett, C.E., of Newark. He described the system at Long Branch, where the outlet is into the ocean, and where great precautions have to be taken in order not to pollute the beach. Engineer Bassett illustrated the working of the plan by diagrams. His description was strictly technical. He said that the system is giving perfect satisfaction and promises to be sufficient for a much larger population than Long Branch now has, even at the height of the summer season. The system is not controlled by the town, but by a company. The town was not in a position to perfect such a system, and therefore the intervention of the company is something to be thankful for, even though sanitarians, as an abstract principle, do not think it well that the sewering of a town should be consigned to a corporation organized only for profit. So far, the Long Branch company have shown no disposition to slight sanitary perfection in their system in order to increase their revenue. This revenue comes from yearly rents paid by householders. Mr. Bassett answered a number of questions proposed by members of the Association.

This system as in operation at Long Branch, was capable of supplying 6,000,000 gallons per day, which would allow 100 gallons per day for each person if the population was 60,000.

George P. Olcott, C.E., of Orange, spoke next, taking as his special topic "The Drainage of Private Houses." He alluded facetiously to the old cesspool walled in with stone and in which the sewage took its place to remain as long as it would. A more modern and scientific mode is the sub-irrigation system introduced into this country by Colonel Waring. Mr. Olcott said that the last thing the builder of a new house thought of, seemed to be the disposal of the sewage; then he wanted a perfect job done for $75 or $100. One of the most objectionable features of house drainage is the water-closet in the cellar, where it is impossible to secure proper ventilation. Mr. Olcott then went into a brief description of the sub-irrigating system, which he said he had seen in successful operation in over a hundred cases. Referring to the evils of the cesspool, as ordinarily constructed, he

mentioned the case of a gentleman who told him of the excellence of a cesspool that, though in constant use, had not been cleaned for a number of years. Mr. Olcott expressed surprise, and made an investigation. The result was a discovery that the soil was gravelly, and that the reason that the cesspool didn't ever require cleaning was that the sewage passed off underground, and in the course of its peregrinations passed into a neighbor's well and caused the typhoid fever that afflicted the neighbor's household. In conclusion, the speaker insisted on the necessity of greater care in the disposal of house drainage.

Dr. E. M. Hunt being next called upon, gave an interesting sketch of the methods of sewage disposal at the Lawrenceville School and Morristown Asylum. He believed that we can show as good systems of sewerage, as successful in operation, in New Jersey as can be found anywhere. The discussion was continued by J. C. Pumpelly, Esq., of Morristown, and others.

NEW JERSEY'S NEGLECTED DRAINAGE AREAS.

The President then introduced Prof. George H. Cook, LL.D., State Geologist, who read a lengthy and valuable paper on the "Neglected Drainage Areas in New Jersey, and What Should be Done to Improve Them." The areas to which attention would be called, he said, lie principally in the northern portion of the State. The neglected areas in the middle and southern sections are numerous, but not so extensive in plots. The speaker went on to give a scientific explanation of the defective areas. Coming down to particulars, he spoke of an area running through Somerset, Union, Morris and Essex counties, in which there is so dead a level that stagnant water gathers and promotes fever and other sickness. Near Little Falls an overflow from the Passaic often causes untold injury to crops, because of this same dead level. The overflow has no means of escaping except by evaporation, and that slow process leaves time for fever germs to form. Prof. Cook contended that an improvement could be made in the situation by removing the dam obstructions at Little Falls, and thus effecting proper drainage. Thousands of acres of farm land would be benefited at least $10 an acre, not to speak of the increased healthfulness that would be given to the whole region now under the evil influences of the local miasma. Other extensive areas in the northern section of the State were spoken of, and suggestions were offered as to methods that might be pursued in establishing better drainage for the defective

localities. Great Swamp, at the headwaters of the Passaic, came in for attention. The whole region in that section was said to be a constant harvest-field for physicians.

Civil Engineer Howell, of Morristown, speaking on the paper, said there was no insurmountable engineering difficulty in draining the valley of the Passaic, but the financial obstructions did seem to be more than could be overcome. He admitted that a great deal of malaria existed in the neighborhood from decaying vegetables, arising from floods, &c.

Dr. F. Gauntt, Rev. Dr. A. E. Ballard and Civil Engineer J. T. Hilton, of Paterson, participated in the discussion, which was closed by Prof. Cook, who spoke of the faulty law which throws the cost entirely on the parties whose lands are drained, whereas it should be on the entire community, because all would be benefited by the sanitary improvements and the increase in the value of all the land in the neighborhood.

EVENING SESSION.

The evening session was held at 7:30 o'clock. President Newton in the chair. Prayer was offered by Rev. Dr. A. E. Ballard, of Ocean Grove, who, with Prof. Nicholas Murray Butler and Surgeon Smith, of the U. S. Army, were invited to sit as corresponding members. The Secretary then announced the annual address by the President. The President then delivered the address. Subject:

SANITATION MILITANT.

Among the fighting sanitary forces of the State, the first, he said, was the State Board of Health, which he termed the sun of the sanitary system, and defined its powers and duties. The second was the local Boards of Health, whose powers and duties he also defined at length. The voluntary Sanitary Association called forth the lavish praises of the speaker as the third factor in the available sanitary forces. The laws upon the statute-books as they stand satisfied conservative sanitarians, and were far in advance of the average intelligence upon the subject. They would have to remain as they are until the people are educated up to a higher standard. Only such

laws as are understood and approved by the people can be enforced. The speaker thought all sanitarians should be thankful that the State Board of Health had always been composed of such faithful men and good sanitarians. No Board, outside of New York, had such control and power as the State Board of Health. "If," said the President, "I can impress upon the local Boards the necessity of selecting good health officers and continuing their terms of office during good behavior, I shall feel repaid for any trouble in preparing this address." He warned the members against expressing positive opinions upon sanitary subjects until a thorough investigation of all facts had been made, instancing a State Board of Health that went so far as to recommend the Legislature to pass a law quarantining consumptives on the theory that the disease was propagated by bacteria. In conclusion, the speaker thanked the Association for the honor conferred by electing him its President.

Upon motion of Dr. H. R. Baldwin, a vote of thanks was unanimously tendered to the President for his very able and instructive address, with the request that a copy be furnished for publication.

(The address has been published in pamphlet form, and copies may be obtained from the Secretary, P. O. Box 87, New Brunswick, N. J.)

The President then introduced the State Superintendent of Public Instruction, Hon. E. O. Chapman, who spoke on the "Length of School Days, Recesses, Competition and Industrial Education." He thought that while each of the four subjects deserved a separate essay, that they were very properly grouped together, as they have a close relation to the health and physical development of the pupils in our public schools. They are the most important questions that are being considered to-day in our school economy. He referred to the criticism that our public schools have been purely intellectual and that the physical development was left to take care of itself, or to be taken care of by others than school officers or teachers, and cited some of the advantages the scholars in our country schools had over those in our city schools in their physical development. The great work of our public schools is to make the future citizens such as the safety of the State requires—reliable, virtuous, self-dependent. If intellectuality can do this then the public school has to do only with the intellect. But the reliable, desirable citizen must have a sound mind in a sound body, and that the modern restraints are not conducive to a healthy physical development we have abundant proof in the pale faces and

spare limbs of the children which are to be seen in large numbers in all our towns. He thought it the duty of this and all similar associations to inquire into the causes which produce these defective physiques. Has the length of our school days and terms anything to do with it? It is not a sufficient answer that the school days and terms are no longer than they were forty or fifty years ago, because the conditions have been greatly changed. He believed the so-called discipline enforced in many overcrowded school-rooms and the mental anxiety produced by the constant physical restraint, are such as few strong men could endure for any continued length of time. What is needed in our schools is more relaxation and less restraint.

It is sometimes argued that many children are certainly as well off in the school-room as they are at home, and better off than when they are in the streets; but even with these children, if we seek to improve their condition we should be careful not to substitute one evil for another. As to recesses, the Superintendent said that he seldom went into a school but that he was impressed with the conviction that the first thing the pupils needed was a recess. He had heard of but two reasons for holding the children in the school-room during the entire three hours of the morning session without a recess, or with only a short recess, during which they are not allowed to leave the room. One was lack of time to get through the recitations; the other was that the moral effects of association in the yard are to be feared. To the first he answered that if more frequent relaxation be necessary to preserve the health of the child, no curriculum should be imposed which will interfere with it. To the second he would say, amend the conditions at any cost so that this association shall not produce evil results.

In reference to competition he thought what he had already said applied to some extent. Competition should not be encouraged to such an extent as will interfere with the child's equanimity and happiness in the school. He was sure that many cases of nervous prostration in young people were caused by nervous anxiety, engendered by competitive recitations, examinations and markings. In reference to industrial education he was thoroughly in favor of it as a means for intellectual development. But it may be said of it that it makes this process of intellectual development a pleasant one, and for this reason alone it deserved a hearty welcome in our schools. The work of education *should be* always pleasant; the school-room should be as

attractive as the home; no task should be put upon the child that will worry or fret it, if it can be avoided.

Prof. Nicholas Murray Butler, President of the Industrial Education Association, was then introduced, and delivered an able and interesting address on Industrial Education.

We insert the following abstract:

SANITARY SCIENCE AND EDUCATION.

"GENTLEMEN—I desire to express my appreciation of the importance of sanitary science for sound educational doctrine and correct educational practice, and to add my testimony to that of the other gentlemen who are to address you, to the fact that your researches and conclusions are of the greatest practical value to us.

"*Mens sana in corpore sano* is as much to be prayed for now as it was in the time of Juvenal, and we are far better equipped than was the satirist or his contemporaries to work toward that end. The sound mind and the sound body seemed to the Roman to be two distinct and separate things whose conjunction was desirable. We have come to know that the two are so intimately related, indeed so interdependent, as to be practically one thing. Aristotle furnished the educators of antiquity with a psychology upon which to base their praxis. It was a wonderful achievement. But the great modern science of physiology, whose beginnings are to be seen in the discoveries of Servetus, Harvey, Leeuwenhoeck and others, compelled the entire rewriting of that science; and the result is an infinitely more complex and accurate and practical, though less final psychology, than that which was bequeathed to us by the great Stagyrite. This new psychology has taught us how truly vital the dependence of mind on body is. We know, for example, that a decreased or impoverished supply of blood to the brain produces mental inertia and lassitude. We know that an organ develops by exercise, and that the neglect of an organ or its excessive stimulation is alike harmful, no matter whether the organ be mental or physical. We can promptly and surely trace the mental results from unduly intense or too prolonged brain-work, from lack of exercise, and from improper nutrition. We are aware, in like manner, of the bodily results induced by the various emotions and passions, by expectant attention, by concentrated will-power, and other mental phenomena.

"Now, it seems to me that it is just at this point that the sanitarian and the educator join hands. Both having a full understanding of the relation that subsists between mind and body, the former brings the results of his studies to the latter, and formulates them into suggestions and rules for the teacher's guidance. The teacher, in return,

adopts these suggestions and rules as parts of his science, and communicates to the sanitarian in due time the effects that follow such adoption. Thus sanitary science is aided in one of its most important applications, and the science of education adds a most valuable chapter to its book.

"Perhaps this co-operation of sanitarian and educator is more ideal than real, but it is nevertheless far more noticeable now than it was twenty-five or even ten years ago. This is proved, if proof be needed, by the fact that instruction in physiology and hygiene, and in the mental and physical effects of stimulants and narcotics, has been generally added to the curriculum of the common school within that period. It is not to be disputed, on the other hand, that much remains to be done. An illustration of this will be found in one of the opening pages of a recent book on the ventilation and warming of school-buildings, by Mr. Morrison, of Kansas City. The author reminds us (p. 18) that 'no subject has been more carefully and intelligently studied than the direct and ultimate effects of improper air on the human system, and that on no subject is there greater unanimity of competent opinion.' School-building goes on, however, year after year, and it goes on in too many cases utterly regardless of whether a child vitiates two cubic feet of air per hour or two thousand cubic feet, whether 62° F. is the better average temperature or 82°, or whether 45 per cent. of saturation is desirable in the atmosphere or 70 per cent. Nevertheless, science and common sense are making headway, and there is every reason to believe that in a few years' time all the school-buildings that are erected, however humble and unpretentious they may be, will be well ventilated and properly heated. * * *

"The educational topics before you are four: (A) the length of school days and terms, (B) recesses, (C) competition, (D) industrial education. I shall pass over the first two in order to say a word about each of the others. These are competition and industrial education. Permit me a few words concerning each.

"Competition may be defined as a common striving for the same end. It involves two or more competitors. As a principle it has long been dominant, not only in business-life, but in the science of economics. It has been prescribed as the proper stimulus for all stagnation, and as the solvent for all difficulties. Of late years, however, a school of economic thinkers has arisen which asserts that unrestricted competition is an evil to humanity and to the State. We are told that it is proved to be demoralizing, destructive, and, as a principle of political economy, inefficient. Have not you sanitarians and have not we teachers reached an analogous conclusion as to competition in our common field? Is not competition, when left to itself, in danger of emphasizing material success at the expense of the disciplinary process? I take it we are all agreed that how a pupil learns is of more importance than what he learns. His faculties are

developed and his character formed by the process of learning, far more than they are by the thing learned. The tendency of unrestricted competition is to alter this relation, to exalt the result, and to depreciate the process. This is contrary to the teaching of mental hygiene, and in consequence is to be condemned by sanitarians and educators alike. I say nothing of the pallid faces, the disordered nerves, the sleepless nights, and the loss of appetite that result from competition for competition's sake. Were those results not present, I should still oppose it as an unsound educational principle. Therefore, I repeat, competition must be restricted and kept within reasonable bounds. This topic gives rise to many other fruitful suggestions, but I must pass them by."

Mr. Butler then discussed the subject of industrial education, and added as follows:

"Time will not permit me to follow out this suggestive theme. I will simply state, in conclusion, a few of the reasons why I consider industrial education a matter of importance to sanitarians. In industrial education, properly organized and administered, I claim that we have for the first time a system that trains all the mental faculties, and each at the proper time and in proper proportion. It gives us no abnormal and mechanical memories without judgment and executive ability, no hunched backs without arms and legs. Every faculty is considered, every power is taken into account. The conditions of nineteenth-century life are kept in mind, and the ideally-educated man is not held to be the mediæval recluse or the eighteenth-century English gentleman. Incidentally, industrial education affords a pleasant and healthful alternation of exercise from faculty to faculty. No one is overstrained, no one is allowed to become atrophied and die. Muscular exertion is called in to supplement and relieve mental activity.

"My own belief is that the mere recital of these facts determines the attitude of sanitarians toward the system which permits and causes them. As friends of educational and scientific progress you will approve industrial education, and then as sanitarians you will indorse it as a long step toward the much-to-be-desired *Mens sana in corpore sano.*"

The discussion of these school subjects was continued by Prof. James M. Green, of Long Branch; Dr. Cornelius Shepherd, of Trenton; Prof. J. Madison Watson, of Elizabeth, and Prof. Linsley, of Jersey City.

SATURDAY, October 29th.

The morning session was called to order by the President, when a resolution was adopted inviting the members of the Association to suggest subjects for papers to be read at the next annual meeting, or to prepare papers for that meeting. Such suggestions should be sent to the Secretary (Dr. English, New Brunswick, N. J.) before June 1st, and all papers prepared for the annual meeting should be sent to him for approval by the Executive Council before October 1st, 1888.

After the transaction of routine business, the President introduced Prof. Shippen Wallace, Ph.D., of Burlington, who read a paper on "Poisons in Foods of Animal Origin." Dr. Wallace referred, in opening, to the advance made in the discovery of the cause of disease. Besides outbreaks of typhoid and scarlet fevers, diphtheria and small-pox, we have also others which, while not as fatal, have caused large numbers to be "laid up" for several days, and no name for the sickness has as yet been given it by the physicians. It has been simply said, "It came from eating such and such food." The reason why partaking of food which, to all appearances, was good, should cause illness was not positively known until during the past few years, with the exception, perhaps, of trichinæ.

He cited the cases in Germany from eating sausage of which the mortality, as given by Böhm, was from 23.2 to 54.2 per cent., also the 343 cases with six deaths reported by Müller, in Holland, in 1874; also referring to the high mortality from fish-poisoning among the inhabitants along the Volga. He then spoke of the outbreaks in our own country, arising from eating of cheese, ice cream and oysters, and the drinking of milk. While there was no doubt as to the cause of these various outbreaks, yet the toxic agent was not discovered and isolated, until Prof. V. C. Vaughan found it in some cheese which had caused illness to over 300 persons in 1884. To this agent he gave the name of tyrotoxicon—cheese poison. He also found it in ice cream and oysters which had caused illness. Dr. Wallace said he had found the same agent in some cheese which had caused illness at Riverton, in this State. Dr. Newton had also found it in the milk that caused an outbreak of illness in Long Branch. The reason why this toxic agent should form is not at present fully understood. In the cases of sausage and fish-poisoning it has been supposed that it

arises from partial decomposition. The investigation of the Long Branch milk case, and also the case of the seventy people poisoned in Michigan from eating oysters, seems to uphold this same view. What "tyrotoxicon" is, chemically, is at present being investigated, with the strong probability that it will prove to be what chemists term "diazobenzol," Prof. Vaughan having already published a preliminary paper to that effect, in which he says, "We think we are justified in suspecting that tyrotoxicon and diazobenzol are one and the same thing, but it has not heretofore been supposed that such a complex substance is formed during putrefaction." He refers to one of the most important results of the study of this subject—the claim that cholera-infantum is caused by this same agent. Dr. Wallace then proceeds to answer the question, How are we to guard against this new-discovered ill that flesh is heir to?

The observance of proper sanitary rules is referred to, especially *cleanliness*, and the Long Branch milk cases are cited as illustrations. The toxic agent was formed in the milk, owing to the improper management of the same, the milk not being cooled until some hours after milking, and while some might claim that this was not "uncleanly," yet if one should raise the lid of a can in which freshly-milked milk had stood for some time without cooling, the odor would certainly not impress him as being clean. If the milk had been properly cooled, and the so-termed "animal heat" allowed to escape, there can be very little doubt that no sickness would have ensued. Fortunately the sickness produced by this poison has not proven fatal if we except cholera-infantum, yet we should urge on all the need of care and cleanliness, especially in the handling of milk and articles of food in which partial decomposition may easily take place, not noticeable to the sense of taste or smell, and so result in the formation of "poison in foods of animal origin."

Prof. F. A. Wilber, of New Brunswick, then opened the discussion, taking up the points of the paper, citing a number of cases, and giving the results of many of the investigations in this and other countries, but regretted that after all we knew so little about these toxic agents.

Dr. W. K. Newton, of Paterson, spoke of cases from eating canned salmon, lobsters and smoked fish, some of which had come under his own observation.

Dr. E. M. Hunt thought it was very important that we should become acquainted with these poisons. He believed there have been no cases reported in which thoroughly-cooked foods have been eaten with harm.

The discussion was further continued by Dr. D. Benjamin, of Camden; H. B. Baldwin, chemist, of Newark, and Dr. H. G. Wetherill, of Trenton.

Rev. A. E. Ballard, of Ocean Grove, was then introduced, and spoke on the subject of "Home Sanitation."

He first spoke of location, and insisted that the spot chosen for residence should be thoroughly drained, both upon the site and in its surroundings, before anything else is done. Then underneath the entire house a large deep cellar with free ventilation. This cellar should be cemented wherever there is any dampness either in its walls or bottom, and the foundation should reach at least two feet above the surrounding level. The ceilings of the rooms should be high, the walls painted and varnished, and the floors generally without carpets. The best ventilation, he believes, is secured from apertures between the floors and the walls, through which the air might ascend and be liberated through any outlet which might be found most convenient. This, with free ventilation through doors and windows, would secure very largely the best probabilities of healthfulness when these were arranged so as to avoid drafts upon the persons dwelling in the houses. Cleanliness is essential. Only one room at a time should be subjected to the process of house-cleaning, and that one be unoccupied until thoroughly dried, when it could be used and another one cleansed. The strictest attention should be given to dampness and also to any vegetable or other matter, in however small quantity, which may lie carelessly around, "as the processes of death in these things are the incipients of the processes of death in us." Dr. Ballard thought that too much attention could not be paid to the water-supply. If there is the slightest doubt of its purity, both filtration and chemical neutralization should be insisted upon wherever it is necessary to continue the source of supply. The frequent use of fire during all seasons of the year is another element of sanitary success. Even in the summer it is needed to drive out the foul dampness which lingers in the corners of the rooms, in order to the purity of atmosphere which is needed. He believed that for privy closets the

"Hopper" arrangements are the best where there is a sufficient supply of water and where there are public sewers. Where this is not the case, deep cemented vaults, with free use of disinfectants, secured, in his judgment, the best results.

Dr. E. L. B. Godfrey, of Camden, was introduced and delivered an able address on "The Collection and Disposal of Garbage." We make abstract as follows:

As to the collection of garbage, Dr. Godfrey discussed both the contract system and that by which the supervision of the work devolves directly upon the municipal authorities. Under the former system the unfaithfulness of the contractor is a frequent difficulty; with the latter, in order to secure the best results, the work should not be left to committees, nor divided among several city officials, but should be made a separate branch of the street-cleaning service, under the direct control of a superintendent, who is responsible either to the executive, legislative or health authorities. He should be furnished with all the force required and all needful appliances for the work at the expense of the city. In Boston, garbage collected under such management is sold, and the revenue therefrom defrays about one-half the expense of its collection and removal.

In the removal of garbage, laws addressed to both housekeepers and scavengers would materially assist matters. Dry kitchen refuse should be kept apart from liquids of any sort, ashes, tin cans, &c., &c., and placed in galvanized iron or non-absorbent receptacles, with covers, and large enough to hold the accumulation of two or three days. These should be thoroughly cleansed as often as they are emptied, and no reliance should be placed on disinfectants. Removals should be made daily in summer and two or three times a week in winter. Garbage carts should be water-tight, lined with non-absorbent material, and fitted with air-tight covers. Water-tight barrels with covers, placed on trucks, are sometimes used, and have the advantage of being cheaper and more easily handled and cleansed.

Garbage may be disposed of in five ways, as follows:

I. Mixing with ashes and throwing upon vacant lots.
II. Feeding to swine.
III. Making into compost.
IV. Removal to the sea.
V. Burning.

1. The practice of mixing garbage with ashes cannot be too strongly condemned. Garbage and other organic refuse mixed with ashes and rubbish decomposes very slowly. Excavations of land made up years previously of such materials, disclosed organic matter still decomposing, thus making it dangerous to live upon, and carrying deadly poison to neighboring wells and springs. Aside from air and soil contamination, the decomposition of organic refuse may also give rise to the germs of specific disease.

2. Feeding to swine is used to the best advantage in the country, where kitchen and dairy refuse is carried twice a day to the hog-pen. In the city, during hot weather, the condition of the average swill-pail becomes such that the contents are frequently full of living animal matter, thus rendering them utterly unfit for food.

3. Making garbage into compost is one of the least objectionable methods for its disposal, but the large shrinkage makes it less remunerative than would at first sight appear. As a fertilizer, it cannot compete in value with sewage and other similar waste.

4. The removal of garbage to sea is an excellent method for its disposal in cities bordering on the coast, and it is done in New York, Brooklyn and Boston. It is carried off in boats and dumped at a safe distance from land.

5. Burning offers a good solution of the disposal of garbage when it has no marketable value, or cannot be carried out to sea. It should, as far as possible, be burnt in the kitchen stove or range, when this can be done without annoyance to the household, but in summer this method is often impracticable. In Glasgow and Montreal, garbage is removed to depots and there cremated, but there are no appliances for its cremation on a large scale in this country. The cost of such a plant renders the method at first sight objectionable, but without a properly-constructed crematory, it is decidedly obnoxious. Their introduction into large inland cities is only a matter of time. The growth of these cities, the constantly-increasing distance from their business centers to the open country, and the higher standards of cleanliness now being enforced in other directions, are strong arguments in favor of crematories for garbage.

Dr. Hunt followed in advocacy of cremators or incinerators, as they are called, and alluded to the thirty or more in use in England, to the one at Montreal and at Wheeling, at Milwaukee, &c. The one at Pittsburgh seems to be a success.

Rev. Mr. Ballard spoke of their experience in Ocean Grove. They had tried feeding swine with the garbage, and found it impracticable; then burning it, but the odor arising therefrom was so offensive that complaints were numerous; their method of composting did not pay. They had adopted the contract system of having garbage carried away, deposited on land which they had bought some distance from the Grove, and had it covered over.

Dr. T. W. Harvey, of Orange, objected very decidedly to the method adopted by New York City of dumping their garbage in the sea to be washed up upon our Jersey coast. The one proper system, in his judgment, was to cremate it—it was the safest and most rapid way.

J. S. Wetmore, Esq., of Englewood, agreed with Dr. Harvey in objecting to the garbage of New York City being washed back, not only on our coast, but also along the banks of the Hudson.

Rev. Mr. Ballard offered the following resolution:

"*Resolved*, That the attention of the Legislature of New Jersey be called to the dumping of garbage from the city of New York at so short a distance from the New Jersey coast as to allow its return both to the ocean coast and the shores of Hudson river."

The resolution was referred to the Committee on Legislation, with power, and, on motion of Dr. Hunt, it was agreed to have a committee appointed to confer with the New York City Board of Health, or the authorities having the matter in charge.

Dr. Benjamin, First Vice-President, presiding, appointed as the committee, Messrs. Wetmore, Hunt and Ballard.

Dr. E. M. Hunt, Secretary of the State Board of Health, was then called upon and read a paper on "Vital Statistics," which is published in the State report.

The discussion of Dr. Hunt's paper was opened by J. C. Pumpelly, Esq., of Morristown. He commenced by quoting the remarks of Surgeon A. L. Gihon, U. S. N.: "The vital statistics of the future must be something more than mere records of so many births, deaths and marriages. Morbility records must also be furnished."

After referring to cholera, yellow fever and epidemic dysentery, and arguing that insanitary conditions had far more to do with the production of these epidemics than climatic conditions, he spoke of the epidemic of dysentery and the increased number of deaths from

diarrhœal diseases among children in Morristown during the past six months. He did not believe, as some physicians affirmed, that they were caused by merely atmospheric influences, "owing to great changes in the temperature," but in most cases to local insanitary conditions, as some of the physicians frankly confessed. There were reported 242 cases of dysentery, twenty cases occurring in one street, in some instances several in one house, and a great number of these were in locations known to be filthy, while for two or three years past there has been some decrease in our general death-rate. Many have failed to notice that the number of deaths from preventable diseases was on the increase, the rate being 2.77. From 1880 to 1885 the mortality rate among infants and children under five years of age, compared with the whole number of deaths, was 26.83; for 1885, it was 25; for 1886, 22.5, while the percentage of deaths of people over sixty for same period averaged 29 per cent., and for 1886, 31.66.

He believed that wherever the proportion of deaths from zymotic diseases to deaths from all causes exceeds 20 per cent., removable causes are present, and that a low death-rate with an excess of deaths from zymotic diseases commonly indicates either that all deaths are not recorded or that the causes are not correctly stated. He believed that there should be published each week as an educational document all the important data obtainable, as to births and the diseases and deaths, keeping with each district in the town, be it high or low ground, clean or dirty, a credit and debit account, which should convey its own moral, and very directly, too.

He would recommend the passage of a law like that in Massachusetts, subjecting the certificate of the cause of death to the examination of the Board of Health of the city or town wherein the death occurred, and thus prevent many mistakes. He spoke of the great importance of the health officer ascertaining the general character of the prevailing diseases, the number and location of cases of the contagious diseases and the number of deaths from each cause, also of a complete record of births and still-births.

In closing, Mr. Pumpelly referred to the great progress made in the collection, compilation and increased study of vital statistics since 1866, when the State Sanitary Committee reported that "these statistics, obtained at large expense, are of little consequence," &c. Now not only the physician, but all classes of men and women are becoming enlightened upon the subject of sanitary science, and thus are

more earnest in the study of vital statistics as bearing so directly upon the question of the prevention of disease. He believed that it would be well if our scholars in the high schools were taught to study the comparative death-rates of those engaged in different occupations, and the loss of life and money by the invasion of epidemics.

Dr. E. M. Hunt spoke of the great need of accuracy in our investigation as to the causation of disease, as deceit lies in generalizing. The physician cannot always have time amid a large practice to thoroughly investigate, but these cases ought to be handed over to those whose business as health officers it is to investigate as to the origin of epidemics.

Dr. W. K. Newton did not believe typhoid fever and dysentery always arise from polluted water, as some seem to imagine. We are sometimes apt to jump at conclusions and condemn certain water without sufficient examination. It needed an analytical and unbiased mind to thoroughly investigate the causation of epidemics.

Dr. F. Gauntt spoke of humidity as being the cause of disease in very many cases, and did not attribute everything to local insanitary conditions. Prof. F. A. Wilber thought that one suggestion in Dr. Hunt's paper should be emphasized as of great practical importance; the presentation of practical hygiene and sanitary intelligence to the public mind by graphic representations to the eye, by diagrams, pictures, and plain, simple statements. He believed, especially, in the pictorial presentation showing the effects of the neglect of hygienic or sanitary laws, and that it does far more to impress the truth than technical instruction.

The discussion was continued by Drs. T. W. Harvey, J. Y. Simpson and E. M. Hunt.

The officers were elected for the ensuing year, with Dr. Henry Mitchell as President.

Drs. W. K. Newton, Shippen Wallace and Prof. F. A. Wilber were appointed a committee to represent this Association at the meeting to be held at Washington, D. C., in January, 1888, to consider the question of securing greater purity in our food-supply.

The President appointed as the Committee on Legislation: E. S. Atwater, counselor-at-law, of Elizabeth, chairman; L. B. Ward, C.E., of Jersey City; E. M. Hunt, M.D., and Hon. E. O. Chapman, of Trenton, and G. D. Saltonstall, M.D., of Hoboken.

After the transaction of other business of a routine character, the

President congratulated the Association on the great progress made in sanitary science, and the practical application of it during the last few years. He spoke of the success of this meeting, highly commending the valuable papers presented and the discussions thereon as exceedingly practical. He also congratulated the people of the State that, within her bounds, there was such a body of men, who are willing to give time and money, from purely disinterested motives, in gathering together from year to year, actuated only by their love of humanity as they endeavor to save and prolong human lives and lessen the sufferings of their fellow-men. He believed that the results of these annual gatherings of the New Jersey Sanitary Association had, in these directions, been of incalculable value.

On motion, the Association then adjourned.

REPORT OF PROF. A. R. LEEDS, PH.D.,

UPON THE WATER-SUPPLY OF COMMUNITIES DRAWING THEIR SUPPLY FROM THE PASSAIC WATER-SHED.

GENTLEMEN—For investigations upon this subject, made prior to the present year, I would refer the committee to the various reports of the Aqueduct Board of Newark; the reports of the Jersey City Board of Public Works; the report of the Commissioners upon the North Hudson County Water-Supply; Messrs. Croes and Howell's report on Additional Water-Supply of Newark; and to the reports of the State Commissioners of Water-Supply.

In accordance with your instructions, I have collected and examined, both by chemical and biological methods, a large number of samples taken from various points in the Passaic water-system, and present the results of these analyses herewith.

My first two analyses were made upon samples collected upon the 27th of June, from the Passaic below the Great Falls, in order to determine the character of the water after receiving the sewage of Paterson. No. I. was collected at a point half way between the falls and the gas works. No. II. from a point opposite the gas works.

	I.	II.
	Grains per gallon.	
Free ammonia	0 0011	0.0011
Albuminoid ammonia	0.011	0.013
Required oxygen (*i. e.*, to oxidize organic substances)	0 629	0.635
Chlorine	0.204	0.204
Hardness	1.16	1.34
Total solids	3.73	3.9
	Volume per cent.	
Oxygen	0.545	0.433
Carbon dioxide	0.012	0.049
Nitrogen	1.103	1.056

GELATINE-PEPTONE CULTURES.

No. I., after twenty-three hours, contained 38,160 colonies per cubic centimetre.

No. II., after twenty-one hours, contained 33,120 colonies per cubic centimetre.

These colonies were demonstrated by means of separate microscopic examinations, aided with appropriate staining fluids, to consist of various species of bacteria, bacilli and micrococci, the last named being especially numerous in the second sample. I did not attempt to discriminate the specific forms, because of the uncertainty at present existing as to which species are pathogenic and which are harmless.

Being curious to know how large a number of microbes would be contained in the water of the Hackensack river, which is a country stream uncontaminated by sewage, I obtained a sample of this water and made a like culture at the same time. It yielded 200 colonies per cubic centimetre. Another sample of this Hackensack water I filtered through a half-inch thickness of porous sandstone, and a third portion through a one-eighth thickness of unglazed earthenware. The microbes were altogether removed in the course of these filtrations, the filtered waters exhibiting no colonies in the gelatine-peptone cultures, even after the lapse of a week.

The next inquiry was directed to determine whether a difference in composition, sufficient to be ascertained by chemical analysis, exists between the water taken above the Great Falls (No. III.) and that taken after receiving the sewage of Paterson (No. IV.) The former sample had no taste and smell; the latter was unpleasant in both respects. They were collected on the same day, July 15th.

	III.	IV.
	Grains per gallon.	
Free ammonia	0.0029	0.004
Albuminoid ammonia	0.0087	0.011
Required oxygen	0.32	0.34
Chlorine	0.23	0.23
Hardness	2 30	2.44
Total solids	4.46	4.81

These differences appear small, but such would not be the case were they multiplied into the many million gallons pouring each day over the falls.

These chemical examinations were extended to samples subsequently collected farther down the river:

No. V. Above tailrace leading to the mills at Passaic, July 22d.

No. VI. Below tailrace, July 22d.

No. VII. Steamboat landing at Passaic, July 25th.

These three samples were not so yellow in tint as the two preceding, but were disagreeable in taste and smell, especially No. VI.

	V.	VI.	VII.
	Grains per gallon.		
Free ammonia	0.0052	0.0052	0.0006
Albuminoid ammonia	0.011	0.0099	0.011
Required oxygen	0.29	0.384	0.54
Chlorine	0.35	0.379	Undet.
Hardness	1.89	2.21	1.50
Total solids	4.43	4.54	3.90
	Volume per cent.		
Oxygen	0.436	0.338	0.462
Carbon dioxide	0.180	0.263	0.121
Nitrogen	1.127	1.112	1.095

On the 27th of July a large number of samples were collected in small sterilized flasks, for the purpose of biological examination only. The cultures yielded the numbers of microbes, per cubic centimetre, set down in the following table:

No. VIII.	Faucet at D., L. & W. R. R. station, Newark	50,000
No. IX.	Passaic river at mouth of Second river	60,000
No. X.	" " " Jersey City in-take	45,000
No. XI.	" " midway between X. and XII	39,000
No. XII.	" " at Newark in-take	50,000
No XIII.	" " " mouth of Third river	60,000
No. XIV.	" " ½ mile above " "	Innumerable.
No. XV.	" " at D., L. & W. R. R. bridge	60,000
No. XVI.	" " " turnpike bridge	80,000

All these numbers are higher than that afforded by a culture of the sample taken at the Passaic steamboat landing, July 25th, which yielded 13,000 microbes per cubic centimetre.

On July 28th, samples Nos. XVII. and XVIII. were collected; the former at the Jersey City, the latter at the Newark in-take, both being devoted to chemical analysis, with the results as follows:

	XVII.	XVIII.
	Grains per gallon.	
Free ammonia	0.004	0.003
Albuminoid ammonia	0.013	0.011
Chlorine	0.20	0.17
Hardness	1.57	1.34
Required oxygen	0.54	0.53
Total solids	3.96	4.08
	Volume per cent.	
Oxygen	0.482	0.351
Carbon dioxide	0.236	0.06
Nitrogen	1.306	0.917

At as early a date after collecting these two samples from the lower Passaic as opportunity would permit (August 1st), I obtained a sample from the upper Passaic. It was collected at the foot of the Little Falls, which are several miles above the Great Falls. A partial analysis afforded :

	XIX.
	Grains per gallon.
Free ammonia	0.0011
Albuminoid ammonia	0.0099
Required oxygen	0.71

This sample was obtained July 29th, and on the same day I obtained other samples for biological examination :

No. XIX.	Passaic river below Little Falls	5,000 colonies.
No. XX.	" " above Great Falls	4,000 "
No XXI.	" " just below Paterson	Innumerable.
No. XXII.	" " one mile below Paterson	72,000 colonies.
No. XXIII.	" " two miles below Paterson	64,800 "

The foregoing examinations were made upon samples collected during the very hot weather of midsummer. And inasmuch as the character of the water in the Passaic river alters somewhat with the season of the year, it appeared desirable to repeat some of these analyses. Moreover, it was important to compare the composition of the waters in the Passaic river with that in the Pequannock river, which is a mountain tributary, with little, if any, population located along its banks.

Sample No. XXIV., collected below Paterson on the 10th of October, contained 0.02 grains of albuminoid ammonia per gallon, and gave strong reactions for nitrous and nitric acid. It was also remarkably low in its dissolved oxygen, containing only 0.297 volume per hundred.

On October 26th, a sample (No. XXV.) was taken from the tap of the D., L. & W. R. R. station at Newark, and on November 2d, a sample (XXVI.) from the Pequannock river, above Butler.

	XXV.	XXVI.
	Grains per gallon.	
Free ammonia	0.0012	0.0023
Albuminoid ammonia	0.0067	0.0073
Required oxygen	0.29	0.22
Chlorine	0.46	0.38
Hardness	3.38	2.15
Total solids	4.43	3.30
Nitrates	0.06	0.025

These were followed by the chemical and biological examinations of two samples collected November 11th; No. XXVII. from the in-take of the Jersey City pumping station; No. XXVIII. from the faucet of the D. & L. R. R. station at Newark.

	XXVII.	XXVIII.
	Grains per gallon.	
Free ammonia	0.0006	0.0003
Albuminoid ammonia	0.0093	0.0093
Required oxygen	0.37	0.31
Chlorine	0.40	0.44
Hardness	3.38	2.97
Nitrites	0.00011	Trace.
Nitrates	0.048	0.062
Total solids	4.84	5.24
	Volume per cent.	
Oxygen	0.53	0.521
Carbon dioxide	0.162	0.111
Nitrogen	1.504	1.239

Both samples were of a faint yellow tint; that from the Jersey City in-take had a disagreeable taste and peaty smell. Its gelatine-peptone culture yielded 88,000 colonies of microbes per cubic centimetre. The sample from Newark had a somewhat vegetable taste and smell, and yielded 12,200 microbes per cubic centimetre.

The following day, November 12th, three samples were collected at higher points—two being taken with a view of comparing the composition of the river before and after receiving the sewage of Paterson, and a third to compare both of these with a sample taken higher up the river. They were:

No. XXIX., from the Passaic river above the Great Falls.
No. XXX., from the Passaic river below the Great Falls.
No. XXXI., from the Passaic river at Little Falls.

The first and last had but little, if any, taste or smell; that taken from the Passaic after receiving the Paterson sewage was disagreeable in both respects.

	XXIX.	XXX.	XXXI.
	Grains per gallon.		
Free ammonia	0.0029	0.0093	0.018
Albuminoid ammonia	0.0076	0.013	0.012
Required oxygen	0.23	0.39	0.24
Chlorine	0.35	0.44	0.35
Hardness	2.44	2.79	2.68
Nitrites	None.	0.00011	Trace.
Nitrates	0.022	0.036	0.022
Total solids	4.08	4.95	5.07
	Volume per cent.		
Oxygen	0.657	0.46	0.56
Carbon dioxide	0.109	0.19	0.07
Nitrogen	1.365	1.45	1.23

In order that it may not be overlooked, I desire to call attention to the percentage of dissolved oxygen in the sample taken below the Great Falls, as compared with that in the others.

The sample taken below the Great Falls yielded 11,500 colonies of microbes per cubic centimetre; the sample taken from above the Great Falls, 5,760 colonies; that from Little Falls, 4,800 colonies.

These samples were all collected on a Saturday. On the following Monday, November 14th, I collected a sample from the Pequannock river, above Butler. It contained:

	Grains per gallon.
Free ammonia	None.
Albuminoid ammonia	0.0035
Required oxygen	0.19
Chlorine	0.29
Hardness	2.04
Nitrites	None.
Nitrates	None.
Total solids	3.26
	Volume per cent.
Oxygen	0.722
Carbon dioxide	0.024
Nitrogen	1.389

It was colorless and odorless, and of pleasant taste. It yielded seventy microbes per cubic centimetre.

I desire to submit the above facts without comment or suggestion.

SUMMARY OF REPORTS FROM LOCAL BOARDS AND DISTRICT SANITARY INSPECTORS.

REPORTS OF DISTRICT SANITARY INSPECTORS.

During the past year the Board has carried on the work of local inquiry and investigation to a degree never attempted before, and, as it seems to the Board, with very encouraging results.

First of all, there was need to see that, as far as possible, Local Boards had been actually formed in each city and township of the State. Even when formed many of these understand their duties far better by personal explanations to some member, or, if possible, to the whole Board, and are incited to more thorough oversight. Still more there was need that most of the Boards pass ordinances, since the carrying out of the laws under these is much more simple than where a nuisance has to be attacked under general laws and abated by the Board, and afterward an action of debt instituted. While much still remains to be done, more has been accomplished in this direction than in all the years before.

Nuisances are constantly arising in which Local Boards desire to avail themselves of the counsel and co-operation of the State Board, or one of its Inspectors. Also, it is frequently found that an Inspector of this Board, because he is not a resident of the locality and is able to present new facts and arguments, succeeds in securing the voluntary prevention or removal of evils which have been in dispute between individuals and the Local Board.

In the outbreak of local epidemics, the visit of a State Inspector is always of signal advantage, although more needed in villages and smaller towns than in those cities in which there is systematic administration. Yet, we regret to say that in any sudden outbreak, too many of our city Boards of Health do not show administrative activity at the very beginning. Too often they resemble a fire brigade which only shows its best capacities after two or three blocks

of houses have been burned. It is sad to have a score die in order to stimulate the health force into working order. Since the inspection system has been established, it is not unusual for Local Boards to ask aid, and thus secure more rapid and efficient measures. It is hardly to be expected that each Board is fully on the alert, but an Inspector who is kept familiar with all the best means to be used, helps to save time and money, sickness and lives.

At first the Board tried a system of County Inspectors. But with two or three exceptions, it was found that physicians who were competent were busy in their own practices, and that while seeking to fulfill their duties to the whole county, they could not, in such a sporadic service, be always on call or keep fully abreast with all the sanitary methods and appliances, and the best application of all the provisions of laws and ordinances in the respective localities.

During the winter months we availed ourselves of the services of Henry Mitchell, M.D., of Monmouth county, and he and A. Clark Hunt, M.D., of Middlesex county, were asked to act as General Inspectors. We have also been assisted by Dr. Mecray, of Cape May county.

Each day's work, and all suggestions made, are reported to a committee of the Board, and also to the Secretary. A special committee aids the Secretary in advisement and direction. To some degree we have extended the work to the examinations of localities, school-houses, work-shops and charitable and penal institutions, to technical examinations and descriptions of sewer and water-works, and it should be extended to many other important sanitary interests of the State.

The following are some brief comments of the Inspectors upon the localities visited, in addition to the full reports from localities which they present to this Board:

NOTES ON DISTRICT INSPECTION.

BY HENRY MITCHELL, M.D., INSPECTOR.

In the southern portion of the State district sanitary inspection has been continued during the past year. In each district visited the detail of operations of the Local Board of Health has been inquired into, and the general and special dangers to the public health in each community and locality have been observed and noted. Such advice

and suggestions as seemed appropriate were, in each case, given, and assistance was rendered in inspection of premises and in judging of the degree of danger to health from suspected sources of sickness and in devising means for their removal whenever opportunity offered.

Moderate progress has been made in nearly all incorporated districts in improving the efficiency of the Local Health Boards, but in certain instances no advance has occurred. Township Boards have frequently failed to apply the provisions of the health laws to their localities.

Two obstacles which, more than any others, appear to prevent better and more rapid advance in municipal sanitation, are: 1. The scarcity of practical and earnest sanitarians among the members of Local Boards of Health, and the consequent lack of well-directed guidance for the operations of the Board. 2. The insufficiency of funds with which to obtain the services of capable health officers and to conduct the necessary business pertaining to the health office. Considerable time must necessarily pass before either of these unfavorable conditions can be overcome, for few men who comprehend the immense disadvantage to the State of sickness and premature death, and who also keep themselves acquainted with the means of promoting health and preventing disease, are available either as members of Boards or as employes.

There seems to be little probability that municipal appropriations will at present be generally made sufficient to defray the expense which attends thorough, systematic and effectual sanitary administration.

One of the results of the past two years' service of the State Inspectors has been to establish closer relations of co-operation between the State Board of Health and the Local Boards. Personal acquaintance has been formed with many individual members of Local Boards, and correspondence has been established which affords opportunity for conference concerning unusual cases and emergencies.

One of the best features of the district inspection service is the conveyance to Local Boards, by the State officers, of information and practical instruction concerning the methods of promoting health which have been tried in other districts and found to be successful. By this means the experience of every Local Board is soon made available in all parts of the State, and it becomes possible for each district to keep abreast of its neighbors in sanitary work, and limits the necessity for

experiment and the delay which generally attends separate and unaided efforts.

There can now remain no doubt as to the desirability of continuing and extending the aid of the State Board of Health, through its District Inspectors, to Local Boards. Indeed, without this or other stimulus, there is strong probability that the interest now existing in sanitary questions among the members of Local Boards will wane, for they generally feel the need of assistance, and hesitate to attack recognized evils until led by others or driven by the outbreak of disease.

The full details of my inspections in various localities, and of conferences with members of Local Boards, are on file in your office, and do not need to be herewith repeated.

NOTES ON DISTRICT INSPECTION.

BY A. CLARK HUNT, M D., INSPECTOR.

It is almost impossible to give a detailed account of the work which has been done during the past year, hence only an outline is furnished. The effort has been to gain, in the first place, organization where it did not exist. There are still remaining some Boards which have never organized, but the number has been greatly lessened by seeing members of the Boards and drawing their attention to the needs of their townships and villages.

Secondly, re-organization. There were at the beginning of the past year a number of Boards which, although organized, had not carried out many of the detail conditions necessary to make them legal or efficient. There are now but few of these, and during the coming year they will be reached and placed in better condition, if possible.

Third, correcting existing misunderstanding. Many of the Boards have never known their duties and have had very vague ideas as to how work was to be done or any good accomplished. Others have had entirely wrong ideas as to the amount of money at their disposal and how this was to be obtained. In the cities many of the Boards were illegal because of the manner of appointment and the length of time the various members held office. This would certainly lead to endless trouble if legal difficulties arose, and has been corrected in many instances.

The State Board, early in the year, issued a circular on the need and mode of passing a code for the guidance of the several Local Boards and increasing the knowledge of the people as to what nuisances were defined to be and the penalty for continuing them. To get the Boards to adopt such a code has been a very essential part of the work. Upon meeting with the different Boards, it was discovered that many of the existing codes were very indefinite and needed a great deal of changing to make them effective. In the townships many of them have been prevailed upon to pass ordinances, and if only the matter is properly explained, and they are made to understand what can be accomplished, they are found willing to do what they can. The effect of these ordinances when in operation is certainly very satisfactory, and many of the Boards look forward to better results in the future. During the year several factories have been visited to ascertain their sanitary condition, and where there existed dangers from overcrowding and neglect of sanitary laws the facts were brought to the attention of the owners and corrected by them, as also reported to the State Board. Several jails have been visited and, as a rule, were found in good condition, although several minor improvements have been suggested and carried out. There were two notable exceptions to this. The jail at Camden has improved, but is still very much out of repair and needs careful watching. Overcrowding, lack of proper facilities for cleansing the closets, improper ventilation and lack of sanitary conveniences, make it still a very unsatisfactory institution and one not at all complimentary to the city or to those who are responsible for it.

The jail at Flemington was in bad condition, but this is, for the most part, due to faulty construction. As a new jail is to be erected, the freeholders will make but temporary improvements which, under the circumstances, will be sufficient.

Wherever nuisances have been reported, and the co-operation of the State Board requested, the Inspector has visited the place and tried to assist in overcoming the difficulties. Several slaughter-houses have been troublesome, but all the owners of them have readily acquiesced in any suggestions made, and immediate improvement has followed. No one of them rendered a second visit necessary. Nine alms-houses, in different parts of the State, have been visited, and with three exceptions, were in good condition. Now, as to the amount of work done, nearly 200 visits have been made to different places, and the different Boards are

getting into the habit of writing for information and asking the Inspector to visit and assist them. As examples of work done, may be cited the formation of Boards at Englewood, North Plainfield, Perth Amboy, Plainfield and others; the renovation of the slaughter-houses at New Brunswick and Gibbsboro, the drainage at Clinton and a number of other instances showing that the effort is having some results which are highly satisfactory. There is much that may be accomplished in a work of this kind, and much to be learned. The different Boards need a great deal of attention and assistance to make them what they should be, and it is only by visitation and becoming more intimate with their conditions and needs that anything can be accomplished. The mere fact that a visit is made to a Board showing what others are doing and that shortcomings are being inquired into, awakens activity and a feeling of their responsibility. It also calls their attention to the laws and to the acquiring of clearer ideas of what should be done. The way some of the Boards wake up to their possibilities of usefulness, is certainly encouraging. The only cause of discouragement lies in the fact that some are listless and careless and do nothing, but there is the belief that with the development of a proper public opinion, this will be corrected. The better people throughout the State are taking the side of proper health measures, and any effort in the direction of securing good health to all its inhabitants; and those who attempt to stay or stop the progress in this direction, must yield sooner or later to a strong public sentiment. There is need that all our public institutions should be more carefully watched as to their sanitary condition. By *irregular* visiting at times when they have not been notified of the coming of an Inspector, many objectionable features may be discovered and obviated.

A detailed report has been made each month, during the past year, to a committee appointed by the Board for that purpose.

During the present year the water-supplies and sewerage system of the different cities and towns, will be investigated. Among the important results that have been attained the past year, is that a more earnest spirit of co-operation between Local Boards and the State Board of Health has been developed. Thus, working in and through each other, very much of good may be accomplished, not only for the Local Boards themselves, but for the citizens who have a right to demand above anything else, that every effort shall be put forth for protection of health, which is admitted to be the greatest of blessings, and most essential to the industries and happiness of the people.

NOTES ON DISTRICT INSPECTION.

BY JAMES MECRAY, JR., M D.

I herewith hand you report of this district.

The water-supply of this city has been increased and proven a success. As our Local Board will describe it I think it unnecessary for me to do so.

During the heated term (July) there was an unusual amount of bowel troubles, affecting all ages, but not of a severe type, readily yielding to treatment. We have been free from epidemics.

West Cape May had an outbreak of scarlet fever in the spring, several cases proving fatal. The Local Board closed the public schools and soon stamped it out.

Cape May Point had several cases of diphtheria in one house. On visiting the place, found the house filthy, one child dead, another very sick, with the entire family in one room. After separating them, having the house cleaned and disinfected, have had no new cases.

The condition of Holly Beach at our visit, it is unnecessary for me to describe, as it is well known to you. Since then the Board has been re-organized and are doing good work. They have had several of the low places graded and are at work on three others. They report that before another season they hope to have the place in good condition. They are having considerable intermittent fever, but no typhoid. The Board meets every week.

The county jail has been repaired, drained and ventilated, as you suggested.

The greatest nuisance in the county is the alms-house. It was built years ago and has nothing to recommend it except the location, which is all that could be desired. The water-closets are about fifty feet from main building and drain into a surface-ditch which runs about 100 feet from the house. The kitchen slops also drain into the same. The building is used by both sexes—different compartments. The hog-pens are about eighty feet from the house (south) and are kept in good condition. The barn about same distance, one portion of which is used for storage purposes (groceries, &c.)

The main building sets about twelve inches from the ground, giving little or no chance for ventilation. It has been changed by additions until the original construction is doubtful. A cellar is under one portion, which is not properly ventilated. Only one room occu-

pied by the inmates has any conveniences for fire except so-called new part or sick-room, which has at this time two beds in. It is entirely too small for hospital purposes. There are two rooms originally designed as cells. They are now occupied as sleeping-rooms and are seven by seven feet, six feet high; no ventilation. The entire row of rooms on main hall are smaller, ventilated by one very small window, and main hall has no proper ventilation.

The are no rooms to separate inmates suffering from contagious disease; no special wards for males or females. There is not a bath-tub in the place.

The hired help sleep in the attic, which has one small window. It is well ventilated by cracks in roof and sides of building.

The death-rate is very high—1886, average number inmates, tweny-six; deaths, four. 1887 (six months), average number inmates, twenty-three; deaths, three.

The place is nicely kept by Mr. Sayre, the keeper—better than could be expected. In fact, the entire house is a model of inconvenience and should be condemned, and a more suitable one erected.

ABSTRACTS MADE BY THE SECRETARY FROM SOME OF THE REPORTS OF LOCAL BOARDS.

The printed schedule, which is sent in October of each year to the Local Boards of Health, for the annual report required of them by Section 37 of the Law of 1887, is as follows:

Names and post-office address of the members of the Board of Health and of the Health Inspector.

The subjects suggested are as follows:

SCHEDULE OF SUBJECTS FOR REPORT.

A. Location, population and climate.
B. Geology, topography and contour.
C. Water-supply.
D. Drainage and sewerage.
E. Streets and public grounds.
F. Houses and their tenancy.
G. Modes of lighting.
H. Refuse and excreta (how managed).
I. Markets.
J. Diseases of animals.
K. Slaughter-houses and abattoirs.
L. Manufactories and trades.
M. Schools and school and other public buildings.
N. Alms house, hospitals and other charities.
O. Police and prisons.
P. Fire guards or escapes.
Q. Cemeteries and burial.
R. Public health laws and regulations.
S. Registration and vital statistics.
T. Quarantine or care over *contagious* diseases, and vaccination.
U. Sanitary expenses.
V. Heat and ventilation for dwellings.
W. Prevalent diseases of the year.

Other subjects may be named under X, Y, Z. The subjects may thus be referred to by the letters.

If the sheet provided is not sufficient, add others, marked with the letters which designate the topic treated.

While some of the subjects have been reported on in previous reports and do not need restatement, most of them call for notice.

All defects at present existing should be carefully reported. Under X it would be well to inform us whether there is any system of house-to-house inspection and whether a record thereof is kept on file.

The number of reports that have been returned this year is more than ever before, and includes all but a very few smaller townships. While some townships are inactive and some so small and healthy as to need but little sanitary activity, there are many others in which excellent work is being done and still more is needed.

While placing on file for reference and for important information all of these reports, for the sake of brevity we only abstract therefrom so much as seems to be especially of general interest or suggestive of local neglects and requirements.

ATLANTIC COUNTY.

ATLANTIC CITY. - *Report from* M. D. YOUNGMAN, M.D., *Sec'y.*

The water-supply during the past summer was ample and of its usual excellent quality, the company having driven a number of wells to increase the supply. This fall they will drive one hundred more wells, in order to have an abundance for next season. The water flows eight miles before reaching the city.

The sewer company are still extending their pipes, and are again at work this fall substituting iron pipe for the terra-cotta pipe placed two years ago, which, in our loose, shifting sand, would not keep jointed. The system received very many commendations during the past season. The company have refused to allow the connections of any more privy-vaults not furnished with patent basins, because of the large amount of refuse in the shape of ashes, carpet, old clothes, bottles, &c., that were constantly thrown in and choked the pipes. Connections are made with the sewer under direct supervision of the Health Inspector.

We had a few cases of the meningeal disease epidemic this fall among horses in this part of the State. All attacked died in from

two to eight hours. No treatment was instituted that seemed of any avail; indeed, there was no time for treatment, so rapid was the progress of the disease to a fatal termination.

A handsome new brick school-house, costing $25,000, was, during the summer, erected and fitted with the most modern and approved sanitary appliances and precautions, under the personal supervision of Dr. Edw. A. Reiley, ex-President of the Board of Health, to whom much credit is due.

No child is allowed to enter school without previously having been vaccinated.

Sanitary expenses are provided as per law, the Board submitting its budget to Council, which body allow such proportion as they deem fit. So far, the amounts allowed, over the per capita of five cents secured the Board by act of 1886, have been very satisfactory.

Heating by grates, particularly those having a cold-air flue, introducing a current of cold air from without over the surface of the fire, then to be heated and passed into the room, are coming into quite extensive use, not only in hotels, but in many private houses. These grates are admirable ventilators.

Steam-heating is becoming year by year more popular and generally adopted, together with a general decided improvement in the manner of building houses, as people realize the permanency of the growth of the city and its growing popularity as a winter resort and home.

There were a number of cases of measles early in the spring, mild in character and of short duration.

EGG HARBOR CITY. - *Report from* FRANCIS NORMAN, *Sec'y.*

Eighty-seven notices to abate nuisances on lots and streets have been served during the past year, and nearly all the nuisances have been, or will soon be, abated.

The drainage has been improved lately by cleaning the creeks running through the city. Said creeks will allow the construction of a public bath, which is much desired.

We have a nice school-house, with large, high rooms, but the heating of this building by a hot-air furnace has failed to give satisfaction. A stove is now placed in each school-room. The ventilation of the school-rooms is good.

With the exception of several cases of measles, there has been no epidemic disease. The general health of the city is satisfactory.

EGG HARBOR TOWNSHIP. - *Report from* Dr. R. SOOY, *Sec'y.*

We have no refuse nor excreta but what are common to each family, and which are disposed of by themselves, except what is brought into the township from Atlantic City as city slops, fæcal matter and garbage, and used by the farmers for fertilization. We have this year adopted a new code of health ordinances which deals with the question of their disposal and use very satisfactorily, and with the aid of a Health Inspector who believes more in education than coercion, we have accomplished good results without the aid of lawsuits as formerly.

Many horses in this township have died with the so-called cerebrospinal meningitis. A number of post mortem examinations have been performed, and in no case were the coverings of the brain or cord found to be involved, but the stomach was found to be for a considerable extent entirely denuded of the mucous membrane, and the throat was in most cases involved. The secretions of the stomach were found intensely acid, and an alkaline treatment in a number of cases resulted in recovery.

In our new code we define nuisances and adopted ordinances for the abatement of such. We restrict, direct, regulate the use of garbage of Atlantic City used by the farmers of this township.

Dwellings heated by wood and coal; each having its own system. Several have heaters put in the cellar and heated by hot air. Fireplaces nearly all gone out of existence.

Much diarrhœa of a very severe type prevailed during the extremely hot weather which lasted the entire month of July. In some localities it affected children most; in others, the adults suffered most.

Only one or two cases of typhoid fever reported to the Board. One of them was at work again in four or five days. The Board did not quarantine the case.

The Board hereby express the thanks of the people and of themselves for the aid and advice given them by the Board of Health of the State of New Jersey.

HAMILTON TOWNSHIP. - *Report from* D. B. INGERSOLL, M.D.

In some parts of this township—and I suppose under like circumstances the same trouble exists in other townships—there are many houses held for rent which are generally void of sanitary principles.

The water-supply is not cared for, and the tenants are forced, at best, to drink surface-water, and often the "*infusion* of toads," or carry all their drinking-water, sometimes a long distance, from their neighbors'. These tenants, not aware of the evil effects of drinking this water, or if aware, not able to avoid it, often drink it for a long time, though it does "*stink a little*," and hence disease and death are their frequent visitors. I repeat that to which I have before called the attention of the State Board of Health, that no house should be rentable unless it has a sufficient supply of good water, as well as a general compliance with other sanitary principles.

In these houses mentioned under F the out-houses are generally neglected as much and even more so than the water-supply. Generally, not even a trough is supplied to receive the excreta, but they are left on the surface until absorbed by the atmosphere, or washed by the rain into the earth, subjecting those who live near to all the evils resulting therefrom.

I speak thus earnestly on this subject because there is no law except our own township laws that is special on this subject, and it often occurs that these landlords have such influence on the Local Boards as to prevent their execution.

If some laws were enacted that would make their execution beyond the influence of the Local Boards the trouble would be the sooner reached and remedied.

We have had no diseases of animals, except in September last, the so-called cerebro-spinal meningitis reached Mays Landing, and was fatal in three cases. The disease was characterized at first by a general dullness, or malaise. This dullness would continue for several days, all of which time some of the horses were worked in the team, but when in the stable were inclined to rest their heads upon the mangers and lean against the partition, throwing their heads occasionally towards the right side. The pulse at this time was considerably increased in frequency, and the temperature higher than normal. Soon the horse refused to eat and rapidly lost strength, until too weak to stand, it fell in the stall, and lay with its head and neck stretched to its full length, frequently throwing its head around to its right side, and every few minutes striking out with its feet, as though in great agony. During all this time its eyes did not lose their natural luster, nor did the horses seem crazed, as some are reported to have been, except as their intense pain caused them to act so. In one instance a

pet horse would winnow and show other signs of affection whenever its master would come near it. The horses died within a day or two after they had become too weak to stand.

I made post-mortem examination of two of these horses, and found the brain and cord with their coverings entirely normal in structure, with no evidence of inflammation at all, and no congestion of the vessels more than would naturally exist after a death of such agony. The heart also was normal. It, however, contained in its cavities some considerable coagula. The lungs were healthy, so with the kidneys. The stomach was partially filled with a yellowish fluid, of a decided acid reaction. The mucous lining of this organ, near the pyloric orifice, extending perhaps half way to the cardiac end, was greatly disorganized; in fact, this part of the stomach was denuded of this lining, and what is worthy of notice, the line of demarcation between the healthy and the unhealthy parts was distinctly marked, as much so as we find it in gangrene or mortification. This marking was not made after death by the fluid in the stomach, because it extended quite around the stomach, and was not confined to its pendent portion. No other markings were found worthy of particular note. With these symptoms and examinations as a data, I could not conclude these cases to be cerebro-spinal meningitis, but rather some disease playing its most conspicuous part on the stomach, and the brain trouble was merely reflex or symptomatic. I will further say that after we commenced treatment for this trouble, thus determined, of a number of cases we treated, we lost but one.

HAMMONTON TOWNSHIP. - *Report from* A. J. SMITH, *Clerk.*

The most serious things with which we have to contend are two slaughter-houses connected with meat markets, and located right in the center of our town; the owners promise and claim to keep them clean, but it requires more care and expense than they choose to incur. The Inspector claims to have called the attention of the owners to the necessity of keeping things in perfect order and cleanliness, and yet the stench that comes from them at times is sufficient to produce bad results, and many are of the opinion that they should be removed to some more isolated locality. I presume that when some epidemic grows out of and can be directly traced to these places, then our people will rise up and demand their removal. Until some one is hurt no one seems inclined to enter complaint.

We have another nuisance, equally as serious as the above but of shorter duration, and that is of bringing into our town and unloading right in our midst night-soil and garbage, in the shape of manure on open railroad cars. In many cases this appears more dangerous than our slaughter-houses, as the handling from car to wagon brings out the stench, so that at times it is fearful and almost unbearable; and yet our Inspector is of the opinion that the law will not sustain an injunction to prevent the railroad companies from transporting such manures into the center of our town. We are of the opinion that railroad companies should have side-lines, a little away from centers, for the unloading of such stuffs. We have one of the neatest lockups in the State: built this year.

P. S.—One of the above slaughter-houses has removed about one and one-half miles out from center of town.

WEYMOUTH TOWNSHIP. - - *Report from* H. GODFREY.

The Board recognizes the importance of sanitary oversight, and looks after these interests in accord with the law of the State.

BERGEN COUNTY.

ENGLEWOOD TWP. - *Report from* J. HENRY ACKERMAN, *Sec'y.*

Location is good; climate is good and healthy.

Water-supply just finished by the Hackensack Water Company.

Drainage and sewerage are being supplied.

Scarlet fever was the worst disease we have had this year—about forty cases and thirteen deaths.

HARRINGTON TOWNSHIP. *Report from* FREDERICK MORRIS, M.D.

The swampy portions of the township were more than usually overflowed this season, accounting, perhaps, for the evident increase of malarial fever—the fever, however, not being of a severe type. Some residents in the valley through which the West Shore railroad runs in this township complain that the culverts of the embankments are not kept properly open, and in one place are insufficient, causing water to remain all summer in places where water did not lie formerly.

ORVIL TOWNSHIP. - *Report from* CHAS. W. BADEAU, M.D.

For the past year the health of this township has been good. No epidemics have prevailed, and no complaints have been made to the Board.

This is a rural district with a scattered population, and no extensive mills or factories.

RIDGEWOOD TOWNSHIP. - *Report from* WM. E. MALTBIE.

Well used on premises of School District No. 61 reported foul. Inspected it and found it tainted by sewage and cesspool-pipes near by. Ordered use of well to be discontinued and the same to be filled up.

BOROUGH OF RUTHERFORD. *Report from* GEO. P. RICE, *Secretary.*

There are no public grounds or parks. The streets are laid out, and within the past year have commenced to macadamize and curb and gutter. Other improvements are under consideration, and the place is growing very fast.

I cannot say that any particular disease is prevalent here. We are subject to all the troubles that other small towns are. The health of the place generally is good. In conclusion, will state Rutherford is a small town which had, up to about two years ago, lain in a dormant state. For the past two years improvements have gone ahead pretty rapidly and new dwellings are springing up all over. At present the place is growing ahead of the powers of our local authorities. Public improvements are being pushed, and within a very few months we trust to see the town in a thoroughly good sanitary condition. We have practical parties working up the sewerage system, water-supply, &c. I trust that next year's report will include many of these improvements.

BURLINGTON COUNTY.

BEVERLY. - - *Report from* HARRY H. MATSON, *Inspector.*

The water is supplied by wells chiefly. A private water company very recently has introduced water-pipes in the northern part of the township, about Edgewater park. The Delaware river is the stream from which the water is taken.

Drainage is generally good. Malaria not prevalent.

The Board of Health passed a code of laws for the government of the inhabitants of the township, so that all nuisances might be prevented. The Board also appointed an Inspector, and by so doing they have lessened their labors and it has been the means of correcting troubles much sooner than it would have been done otherwise.

BORDENTOWN. - *Report from* WM. H. SHIPPS, M.D.

We get our supply of water from Crosswicks creek; a private company furnish it to the citizens. The number of houses taking the water is 300. It is at times discolored, more particularly after a rain; water hard. The quality of the water is not perceptibly affected by seasons. The reservoirs are cemented, and cleansed as occasion requires. About 100 yards above the point of supply a small stream flows into the creek. This receives the drainage from two shirt factories, one tomato factory and a number of private dwellings in the city. About 300 families depend on wells, and about 100 on cisterns.

The prevailing system of drainage in Bordentown is surface drainage. During the past year a private organization has constructed a sewer on Second street, running north from Crosswicks a distance of 200 yards. Another is now being laid on Crosswicks and Walnut streets, running west of Second street a distance of 300 yards. The former is of terra-cotta pipe, six inches in diameter. The latter of the same material, twelve inches in diameter; this is owned by the city.

Our cellars, for the most part, are dry. There are swamps or low lands on the western and northeastern aspects of the town. Houses in the vicinity of these swamps are affected by malaria in the spring and fall months. Diseases of a malarious nature do not prevail to any considerable extent at any season of the year.

Cesspools constructed within the last five years are cemented, and contents removed by means of the odorless apparatus.

There is a register kept by the Board of Health as to the number of persons keeping horses, cows, hogs, &c., in the city.

We have no slaughter-houses in the city limits, and do not intend to have.

The ventilation of the school building is by windows and doors, and

is by no means the best that could be suggested in a differently constructed building. The heating is by stoves and portable heaters, and is open to several objections both as to amount and quality.

We have an active Board of Health, good health laws and regulations, and insist upon their prompt enforcement.

Vital statistics are carefully kept, and, so far as I can learn, faithfully reported.

BURLINGTON. - *Report from* CHARLES STEWELL, *Inspector*.

The source of water-supply is the Delaware river. It is a public supply, the business of which is transacted by a Board of Water Commissioners appointed by the Common Council.

There is a good system of drainage by Drainage Commissioners; a pumping station at the sluice upon the bank of the Delaware river. It is distinct and entirly separate from sewerage.

One sewer some four squares or blocks in length, the walls thereof of brick laid in cement. The sewerage of this city is not of any magnitude. Houses generally have cellars. Cesspools generally of brick and cemented, with sides for emptying; emptied generally in winter, at night, by men who cart contents outside of city limits for compost. Diphtheria was for a time prevalent.

CHESTERFIELD TOWNSHIP. *Report from* CHARLES B. HOLLOWAY.

The general health of the township has been good during the past year, but at present there are a few cases of the chills in the vicinity of Crosswicks. The water-supply is from wells, springs and cisterns. The water from the wells is generally considered good. Most of the cisterns have filters and not much used for drinking purposes.

As a general thing the drainage is good, there being no swamps or marshy places.

The houses are principally frame, with cellars which are used for storing vegetables, well drained and generally dry; very few occupied by more than one family. Refuse and excreta being disposed of, as is customary among farmers, upon their land. No disease among animals, with the exception of cholera among fowls. Our school-houses are all in good repair and well attended.

CINNAMINSON TOWNSHIP. *Report from* J. D. JANNEY, M.D., *Sec'y.*

Water-supply by wells and cisterns, mainly wells. Water of good quality for drinking. Cisterns used for washing purposes chiefly. I think there are not over five families in the township depending upon cistern-water for drinking, and in those cases filters are used.

Surface-drainage principally. A few families in Riverton, on the river-bank, drain into the Delaware by underground means. Farmers use tile-drain largely where needed.

I know of no basements used for any but cellar purposes. There are very few houses without cellars. Cellars are used largely for the storage of vegetables. I know of no tenement-houses of more than two families, and very few containing over one family.

I know of but few sewers; these drain into cesspools, cemented, and emptied by hand for fertilizing purposes. There are a large number of cemented cesspools under privies in Riverton and Palmyra emptied by hand. Privies in the township are largely without cemented cesspools, and in villages during summer are highly offensive to the inhabitants whose olfactories are sufficiently cultivated to distinguish between good and bad odors. This and pig-pens are matters requiring much attention at the hands of the Health Inspector of our township. Many privies in villages are within fifty feet of the family water-supply—the well. Some farmers persist in placing their cow-yards and pig-pens much too near and westward from the dwelling, allowing the prevailing winds to carry the poisonous effluvia emanating from them to the family.

Miasmatic fevers have prevailed in the township to about the usual extent during the year; very few cases of diphtheria or scarlet fever.

EVESHAM TOWNSHIP. - *Report from* WILLIAM L. BROWN.

No prevalent disease. The Assessor inquires each year as to losses of animals and as to contagious diseases. Has not found any in the township this year.

But one slaughter-house in the township. It has been inspected; not complained of as a nuisance.

LITTLE EGG HARBOR. - *Report from* T. T. PRICE, M.D., *Sec'y.*

Whooping-cough and measles epidemic last spring. No other. Cerebro-spinal meningitis among horses in September.

MANSFIELD TWP. *Report from* Dr. D. G. VAN MATER, *Inspector.*

It has been generally healthy here with the exception of measles in February and March and typhoid fever in July and August.

SHAMONG TOWNSHIP. *Report from* J. CLAYTON BUCKAGE, *Sec'y.*

This township is very healthy at the present time. Last January there were six cases of scarlet fever at Atsion. The school was closed and it did not spread. I ordered all the children that had the fever not to attend school for one month. The farmers' horses were taken with a disease and I think about twenty horses died.

SOUTHAMPTON TOWNSHIP. - *Report from* SAMUEL E. BRANSON.

Cesspools mostly open. Refuse is carted out on land. This the Local Board has brought about during the last few years.

We had one case of diphtheria which the Board of Health was called upon to investigate. The township physician and committee met and came to the conclusion the best thing to do was to quarantine the house, which they did. The disease was brought from New York by visiting friends. By the Board taking this case in hand the disease did not spread, although it proved fatal to two children of the family.

CAMDEN COUNTY.

CAMDEN. - *Report from* SEPTIMUS KNIGHT, *Asst. Inspector.*

Water-supply from the Delaware river. Very nearly all houses are supplied from the city water reservoir, with the exception of those in the Eighth ward, which mainly get supply of water from wells.

All houses used for dwellings have cellars, with but few exceptions, those below Second street, in the lower part of city, being very damp, and in many cases not fit for any purpose.

Sewers are used to carry off all surface-water from streets; also to carry off excrement from cesspools and privy-vaults. All cesspools constructed since the 19th of August, 1886, have been required to

have wall and bottom built of brick, eight inches in thickness, laid in cement.

All properties abutting on streets in which there is a public sewer are required to place hopper water-closets on premises, and no wells or cesspools are allowed to be constructed on such streets.

We have made this year a rigid inspection of slaughter-houses and have had no complaints of same.

There are marshes extending across the lower part of the Fifth and Sixth wards and into the Eighth, which are supposed to have caused chills and fever, which have been prevalent during the summer in the lower wards of the city. This Board will have the meadows ditched as soon as possible, so as to drain said meadows.

CENTRE TOWNSHIP. - *Report from* JOHN H. JACKSON, *Sec'y.*

The general health of the township for the past year has been remarkably good. Several cases of typhoid fever occurred during the spring and summer, but none of them were fatal. The amount of malarial fever has been less than last year.

The drinking-water is almost universally obtained from wells either dug or driven, but principally from the former.

Our natural facilities for drainage are good and cellars are principally dry.

Human excreta are received in privy wells. The mode of emptying is mixing coal ashes or marl with the contents, and removing a short distance and covering with earth.

There are four public school buildings in the township, and the various Boards have used every precaution to procure good sanitary conditions.

DELAWARE TOWNSHIP. *Report from* W. S. LONG, M.D., *Inspector.*

During the month the Sanitary Inspector has visited the three schools whose districts are entirely within our bounds, and has found the buildings good, with sufficient means for ventilation and not crowded. In School District No. 8 the building has the disadvantage of two windows facing the scholars. The privies are all on the surface, and are not sources of danger. The water is good. I find that

thus far no attention has been paid by the clerks to the question of vaccination of teachers and scholars.

At a meeting of the Board on October 18th, 1887, the model code of ordinances as advised by the State Board, was adopted, with the exceptions of Sections 8 and 9.

HADDON TOWNSHIP. - *Report from* J. STOKES COLES, *Secretary.*

Water was introduced into our borough by a private company last spring and summer; there are not many taking it as yet; I suppose some fifteen or twenty have it, and think others soon will. There are always some difficulties in the way—of fault-finding, &c. I will give you the analyses of the Haddonfield water company's water:

	By Prof. Wood, Harvard, Oct. 6th, 1886.	By Dr. J. R. Stevenson, Haddonfield, April 9th, 1887.
Appearance of water	Clear.	Clear.
Degrees of hardness	1.00	2.8
Chlorine (grains per gallon)	0.6	0.6
Solid residue (grains per gallon)	6.4	7.9
Free ammonia (parts per million)	0.004	0.094
Albuminoid (parts per million)	0.1	0.048

The source from which taken may receive some sewage above the point of supply in time of heavy rains, but the supply is arranged so as to drain it very quickly, and the supply is ready for pumping again in an hour or so, soon as the gates are closed. The families mostly depend on wells; some have cisterns.

New buildings mostly, if not all, have cemented cesspools; the most of them are emptied by carting away and using as a fertilizer.

Typhoid and typho-remittent fevers made their appearance in Haddon township the last of summer and in September, and a few cases have been fatal. Five cases of scarlet fever have been reported to the Board of Health during the year, and one death. Thirty-two inspections of properties have been made by the Inspector during the past twelve months. The nuisances consisted of one flowing privy vault, improperly constructed, overflowing cesspools and sink-holes, stagnant pools of rain-water and filled-up gutters, badly-kept pig-pens, rubbish, manure piles, &c.

I should have said that the water supplied during last summer we think an ample supply of good spring-water. It has been delivered through the principal streets by a pipe-line from a stand-pipe at one end of the town. The water is obtained from a reservoir about three-quarters of a mile away. Spring-water, surrounded by a bank and forced up by steam.

STOCKTON TOWNSHIP. - *Report from* EDW. C. PEDIGREE.

The water-supply of this township is chiefly wells. We might say that almost the entire population depend on wells. A few receive their supply from the Merchantville water works.

Sewers we have none. Tile drainage and clearing of swamps and filling up of some low land have done something to improve the sanitary condition and prevent malaria. In the most of the township the cellars are dry.

Cesspools are not as a general thing cemented, and are emptied at the discretion of the owner of premises.

Have no trouble in getting the vital statistics, as there is but little neglect on the part of the people in this respect.

CAPE MAY COUNTY.

ANGLESEA. - - *Report from* F. H. HEWETT, *Secretary.*

Water-supply mainly cisterns, with some wells, the water of the last sometimes, when the springs are low, being slightly discolored. About one-half of inhabitants depend on cisterns, the rest on wells.

Drainage surface with a fall of two-tenths to the hundred feet. There is during the wet season water in many of the cellars.

CAPE MAY CITY. *Report from* F. SIDNEY TOWNSEND, *Sec'y.*

Our water-supply is excellent and is furnished by the city, who own and control the works. A large surface well thirty feet in diameter, twenty-eight feet deep, with thirteen-inch walls from bottom to top, laid in hydraulic cement, reaching the second or lower springs, is our source from which water is supplied. It is free from

impurities; is of regular quality and taste. Its location puts it beyond the possibility of sewer or surface contamination, as it is located in the country north of the city, in a sparsely-settled district surrounded by high farming lands that really slope in every direction from the center of the well-site, and as a further safeguard the city purchased five acres of land surrounding the well.

Our geographical location naturally gives good drainage for the soil, but a system of sewers penetrates the heart of the city, affording ample drainage for domestic purposes, perhaps as good as any of the leading cities. So far this year no stoppage of the main sewers has been brought to the notice of the Local Board.

Cesspools built during the year have been constructed in conformity to the law, with cemented sides, and generally cleaned every six months or oftener.

No new or fatal diseases have been observed among our people since last report, excepting during July several cases of acute diarrhœa were treated, both among the resident and visiting population to the sea-shore during this period. No local causes could be ascribed; it was observed at the commencement of an unusually heated term and disappeared with the cooler weather that followed during August. Our resident physicians held it in check and no cases proved fatal from this cause; otherwise the city has been generally healthy.

LOWER TOWNSHIP. - *Report from* WM. C. RUTHERFORD, *Sec'y.*

We have had as a prevalent disease among the children of our township, in the latter part of last winter, scarlet rash or scarlet fever. There were about twenty to thirty cases. There were only two or three deaths. With this exception it has been very healthy. The Board of Health have not been called out to abate any nuisance during the year.

UPPER TOWNSHIP. - *Report from* RANDOLPH MARSHALL, M.D.

The few cases of scarlatina simplex and rubeola were so benign as to require little or no treatment.

A very malignant case of typhoid fever was transported here, February 1st, from Port Richmond, Philadelphia, in a young man twenty-one years of age, attended by apparent perforation of the

bowels, the shock lasting forty-eight hours, characterized by profuse colliquative sweats, total unconsciousness, lividity of skin amounting to a distinct purple hue over abdomen, which finally yielded to a large fly-blister and heroic clysters of ammoniated whisky, laudanum and turpentine. After convalescence appeared fairly established, patient suffered an acute attack of meningitis. Was treated with inunctions of iodoform and lanolin to shaven scalp. Internally, iodide of iron, alternated with cod-liver oil mist., with bromide of potassium and aconite, q. s., to regulate convulsions. Patient was out of doors for the first, July 9th, weighing eighty-seven pounds. The following October 1st, he had gained to 145 pounds; the greatest increase of flesh being a gain of twenty-one pounds in eleven days.

A fatal epidemic prevailed amongst the horses of this township. Forty-one head suffered from the disease; of this number only four recovered. The carcasses were all buried by order of Local Board of Health.

WEST CAPE MAY. - *Report from* R. C. HILL, *Secretary.*

The residents of this borough derive their water-supply from wells, surface and tubular. As a rule the water is soft and free from any bad taste. In the vicinity of the meadows and low lands, tubular wells, driven eighteen or twenty feet furnish a good supply of water, clear, cool and with no unpleasant taste or smell.

No safeguard has been provided against fire. If, during windy weather, a fire should break out in our midst, great damage would result.

The health laws suggested by the State Board have been adopted, with necessary ordinances regulating the keeping of swine and carting the slops and depositing the refuse from the neighboring city of Cape May. At the establishment of this Board there was a disposition among some to object to the enforcement of the health laws, but at the present time little trouble is required to regulate such matters.

This Board had no occasion to adopt any special measures in the contagious diseases among children, beyond making necessary suggestions and advising necessary precautions to the families having sickness in their midst.

The only prevalent diseases of the year have been scarlet fever and measles. Several deaths occurred from scarlet fever; none from

measles. When it was found the fever was threatening to become prevalent, we at once closed the school, and kept it closed until its violence had abated somewhat.

CUMBERLAND COUNTY.

COMMERCIAL TOWNSHIP. - *Report from* DAVID MCELWEE, *Clerk.*

There are about 1,200 acres of meadow and swamp in the township subject to inundation by tide-water, and there is a prevailing opinion among the inhabitants that the tide-meadows cause the malaria in and around Mauricetown. The hog cholera has broken out afresh again this fall.

DEERFIELD TOWNSHIP. - *Report from* CHAS. C. PHILLIPS, M.D.

Our township being situated high, with good surface drainage, we are peculiarly circumstanced as regards conditions for health. No epidemics have visited us during the last year. We have had but few deaths, and those mostly of elderly persons, from causes not dependent on want of proper sanitary regulations. During the months of July and August there was a greater predisposition to bowel affections, such as cholera morbus, diarrhœas and dysenteries, than for several years past, but easily accounted for by the hot summer, accompanied with an excess of moisture, rendering those parts of the body more sensitive to exciting disturbing causes. They were all amenable to treatment, no deaths having occurred. No malaria exists in our section of Cumberland county, as we have but little to produce it. At the same time we find that quinine exerts a very happy influence upon the progress of disease amongst us.

Being an entirely rural district, without any town of any size, we consequently have not those causes of disease that exist in cities and thickly-settled countries.

DOWNE TOWNSHIP. - - *Report from* GEORGE CHANCE.

The natural drainage is fair, but no artificial means have yet been employed.

During the present summer a fatal epidemic of cerebro-spinal

meningitis among horses has visited our township, and the disease in every case so far as known has proved fatal.

There are two slaughter-houses in the township and they are generally in a good, healthy condition.

The public health is looked after by the Local Board of Health, who are taking quite an interest in the matter.

Registration and vital statistics are carried out according to law.

Quarantine and care over contagious diseases and vaccination are carried out according to law.

FAIRFIELD. - - *Report from* J. C. APPLEGATE, *Inspector*.

Excreta deposited in out-houses and carted away by farmers and used as fertilizers.

Cerebro-spinal meningitis among horses, and hog cholera.

Various throat affections, pharyngitis, &c., have occurred, accompanied by bronchitis in many cases; also some isolated fever, but mainly those diseases originating from malarial poison. No epidemics during the year.

GREENWICH TWP. - *Report from* SAMUEL P. FITHIAN, *Secretary*.

Owing to the township not being very thickly settled, it has heretofore been impossible to get our Township Committee to see the need of organizing a Township Board of Health. During the past year there has been erected within the village a storehouse in which to store a fertilizer made of the refuse of sturgeon and menhaden, and the offensive odor emanating therefrom became a source of discomfort to persons living or passing in that vicinity; and great complaint coming from the people, the committee at last were willing to organize and adopted the "Health Code." Since its adoption the nuisance has been abated and the people satisfied. Outside of this, there has been no work in particular for the Board to do.

LANDIS TOWNSHIP. - *Report from* GEO. DAVIDSON, *Secretary*.

We have made a house-to-house inspection this year and distributed circulars.

LAWRENCE TOWNSHIP. - *Report from* E. T. BLACKWELL, M.D.

The only manufactory employing many persons is engaged in the canning of tomatoes. It is located at Cedarville, adjacent to Cedar

creek. It employs over 100 persons, of whom the most part are women and children.

During the second week in September a complaint was lodged with the Board of Health against this place on account of foul odors which were very obnoxious to near-by inhabitants. A meeting of the Board was held September 17th, and all the members having viewed the surroundings, found a bad condition existing.

As a result of their observations and inquiries the Board unanimously declared the premises unsanitary in several particulars, and a nuisance. The proprietor being invited to the session, was instructed to dig a ditch sufficient to carry off the liquid refuse, to remove that which was more solid from the property, and to allow no further accumulation thereon. He was also directed to furnish proper water-closet accommodations for the help employed, and to keep his place in a cleanly, sanitary condition. As the season was far advanced, and the proprietor expecting to cease operations on this ground after the present year, the agreement, on his part, was only partially carried out. The Board, however, have reason to believe that the principles they have inculcated will influence the methods brought to bear in the construction and arranging of any factory that may hereafter be erected within the boundaries of this health district, and therefore report progress.

There are three school-houses in the township in good sanitary order. The largest and most central is heated by steam. The District Clerk, in taking the census, makes inquiries respecting the vaccination of the children.

MAURICE RIVER TOWNSHIP. - *Report from* S. M. WILSON, M.D.

Allow me to report that the general health of Maurice River township, Cumberland county, has for the past year been above the average. I think there has been a smaller percentage of mortality than usual. The sanitary condition is good, with one or two exceptions, where the Local Health Board has had somewhat of trouble to abate nuisances.

MILLVILLE. - - - *Report from* L. H. HOGATE.

Millville has had a fairly healthy year, there having been 186 deaths from various causes.

The Local Board of Health has been on the alert and has taken every precaution possible against disease. The water-supply of the

city is from two sources, water works, owned by a private firm, and wells; the water of the former is soft and comparatively free from iron, that of the latter is pure and sweet generally, owing to the porous character of the soil.

There are no sewers in the city and all the drainage is surface, which is very good, considering the flatness of the country. The city annually expends $5,000 to $6,000 on roads and streets and gives attention to drainage.

The slaughter-houses within the city limits are carefully guarded and are not at all offensive.

Attention is generally given to the lighting and ventilation of school and other public buildings, and much care exercised, especially with the former.

The cemeteries and burying-grounds are kept in excellent condition, and much care is exercised by the manufacturing firms in keeping the cesspools of their tenement-houses in good and clean condition.

There have been no prevalent diseases until during September and October. There have been several deaths from a malignant form of diphtheria.

There has been a great deal of throat trouble, and croup has claimed several victims.

The Local Board was and is vigilant, and adopted measures to prevent the spread of the disease.

ESSEX COUNTY.

BELLEVILLE TOWNSHIP. *Report from* D. M. SKINNER, M.D., *Pres't.*

There is nothing of special interest to report this year, other than that the Board of Health organized early in the spring and appointed an Inspector, who has made an efficient examination of the sanitary condition of the township. That it was needed may be inferred from the fact that as a result of his work fully fifty privy vaults have been thoroughly cleaned, cesspools emptied, and there has been a general cleaning of yards and inclosures.

The summer has been marked by an absence of sickness of all kinds incident to warm weather.

BLOOMFIELD TOWNSHIP. *Report from* WM. H. VAN GIESON, M.D.

The health of this township during the past year has been very good indeed. During the winter and early part of the spring, we had a number of cases of scarlet fever, some of which were of the malignant type, but the number of deaths was very small in proportion to the number of cases. Outside of this, we have had no other contagious diseases. The complaints made to the Board have been regarding drains and cesspools. These nuisances have been in all cases abated at once upon notification to the property-owner or lessee.

CALDWELL TOWNSHIP. - *Report from* GEO. C. BURNETT, *Sec'y.*

Our people have been observant of the laws and regulations in respect to public health, and there has been no complaint. The present year has been one of the most dreaded, as our lands were overflowed about the beginning of July. As the growing grass and vegetation at that time was heavy, it became a great nuisance from decay and rot, producing more or less fever, but not as extensive as was feared.

IRVINGTON. - *Report from* D. S. SMITH, M.D., *Inspector.*

The Board of Trustees of the incorporated village of Irvington, at one of their meetings in May last, appointed a Board of Health. The Board convened, appointed D. S. Smith, M.D., Inspector, and organized under the laws passed by the Legislature at its last session. They passed ordinances and adopted such regulations as they thought requisite to promote the best interests of the public, which have been judiciously and satisfactorily carried out. The sanitary condition of the district over which they have control is all that could be desired, and quite a large amount of accumulated filth has been removed. Owing to the short time of the Board's organization, their report is somewhat brief. We hope in the next to forward you a very complete statistical report. I inclose a proof of the ordinance as passed and acted upon by the Board. It is also printed, in large type, on Bristol board, and circulated freely among the people.

EAST ORANGE TOWNSHIP. *Report from* DR. T. R. CHAMBERS, *Sec'y.*

The water is supplied from three large wells, which continue to furnish an abundant supply of excellent water of medium softness.

The cesspool is about to be superseded by a sewerage system. The pipes will be laid by December throughout the principal parts of the township. It is the small-pipe system, eight inches being the smallest size. The disposal works proper are placed at the lowest part of the township, at its northerly boundary, and consist of fourteen acres of drained land. The building is a very beautiful blue-stone structure, artistically planned and finished; and, when the grounds shall be finished, it will be in the midst of a cultivated park. The disposal system proper is, first, the admixture of chemicals with the sewage as it comes from the town by gravitation, with flushing tanks at suitable places. Secondly, precipitation, for which two sets of tanks are provided. Thirdly, irrigation. Fourthly, downward filtration.

During July and August there were about fifty cases of dysentery in town. Not over a half-dozen died from the dysentery.

LIVINGSTON TOWNSHIP. *Report from* GEO. E. DE CAMP, *Secretary.*

The health in the township has been generally good, except in those parts near the Passaic river, where there has been more or less malaria.

MILLBURN TOWNSHIP. *Report from* ISAIAH WILLIAMS, *Secretary.*

There is nothing new to add about the topography, &c., of this town not contained in my report for 1881. You all see by my report for 1886 the energetic way we dealt that year with minor nuisances. Since then we have had no trouble, it being well understood that we mean *business.* We adopted verbatim and in due form of law the code recommended in your report for townships. I have written to you and mentioned to you personally at Madison the bad effects of impounding of the water by "Factory pond," and the Rahway river, in this township, and of the Scudder pond, in the adjoining township of Springfield.

MONTCLAIR TWP. - *Report from* JAMES S. BROWN, *Inspector.*

A public water-supply has just been introduced and will be in use in a few weeks. The supply is taken from large wells in outlying parts of the township. Hitherto we had our wells in our own yards. Most of these wells are drilled, some are dug.

No system of sewerage, as yet. Tight cesspools are mostly used. These are emptied at regular intervals by odorless excavators, and contents carried away to some appointed place outside the populous portion of the township.

The year has been one of good health. Very few contagious diseases at any time. Perhaps a half-dozen cases of typhoid in the twelve months, and these traced to two wells.

NEWARK. - - *Report from* DAVID L. WALLACE, M.D.

The intercepting sewer which had been in process of construction for the past two years is now completed and has more than demonstrated what was promised of it. It receives the drainage of 7,531 acres, in which area there are 14,422 feet of sewers. The total daily flow for this section of the city is estimated at about 10,000,000 gallons from house drainage. The daily flow from the storm-waters allowed for, would give about 20,000,000 gallons more, so that the maximum amount to be pumped at present will be about 30,000,000 gallons per day. Any increase in the storm-water beyond the 20,000,000 gallons mentioned above is carried on through the trunk sewer beyond the interception and passes to a large canal dug in the meadows, through which it is conveyed to the bay. At a point about 3,000 feet from the pumping station there is a considerable increase in the size of the intercepting sewer, to allow two other branches (which will ultimately be constructed from the other sections of the city) to connect. The sewage and storm-water are then carried to the deposit sewers, where all the solid matters settle to the bottom, to be removed at intervals, man-holes and filth hoists being provided for that purpose. The liquids then pass on into the pump well. From here the sewage passes by four 36-inch suction pipes to as many special pumps. From the pumps the sewage passes through the discharge pipes into the discharge well, and from there into wooden flumes, whence it passes out to Newark bay about 2,000 feet from shore. A complete description of this work with illustrations can be found in the *Sanitary Engineer* of May 7th and 14th of last year, and is worthy of perusal, and an inspection of this system is always open to any one desirous of seeing it.

The work of laying the oblong granite blocks on our streets is still being carried on, some four miles having been laid since last year.

During the year ending October 1st, 1887, in house-to-house inspection alone, 5,487 houses have been inspected, with the finding of 1,142 nuisances. Of these, 1,087 have been abated. In addition to this, 408 cases of defective plumbing and drainage have been rectified.

A health code is now under passage and in a short time will become a law, after which two or three thousand copies will be struck off and published in book form for the guidance of our citizens.

During the year the following condemnations have been made by our Meat Inspectors:

	Number.
Cattle, beef	7
Calves	60
Sheep	46
Hogs	1

Articles condemned in market:

	Pounds.
Beef	1,590
Pork	525
Mutton	575
Veal	305
Sausage	730
Poultry	1,221

Also a large quantity of fruit and vegetables.

Summary of work done during the year:

	Number.
Notices served for the abatement of nuisances	2,257
Abatements	2,065
Notices served for rectifying defective plumbing and drainage	992
Cases rectified	878
Sewer permits granted	1,071
Permits granted for cleaning privy vaults	2,499
Permits granted for cleaning cesspools	588

ORANGE. - - - *Report from* JAMES Y. SIMPSON, M.D.

The water-supply is by the city, and the quality of the water, although for a few weeks not so free from impurities as to be entirely satisfactory, was still a decided improvement over that of former years. These impurities are caused by decaying stumps and other vegetable matter in the reservoir; these being removed a very satisfactory condition of the water may be anticipated.

The water-supply is by a large reservoir which is constructed west

of the city and over the mountain. The reservoir is supplied by a small river. The water is remarkably pure, but becomes somewhat contaminated in the summer from vegetable matter in the reservoir. The water reaches the city by gravitation, and is ample for domestic and fire purposes.

Having no sewer we have to trust to cesspools, privy vaults, and local filtration method, for the disposal of our sewage. The emptying of the cesspools and vaults is performed by licensed men only.

GLOUCESTER COUNTY.

GLASSBORO TOWNSHIP. - *Report from* I. ISZARD, *Inspector*.

The water-supply is from wells and is of a good quality, mostly soft.

Drainage has been better this year, as the overseer is giving more attention to keeping the drains and all of the gutters leading to them in a cleaner condition. so that there is not so much obstruction to the flow of water. In some parts of the town the cellars are somewhat damp.

Many of the working class are building homes of their own. Nearly all have cellars, used for storage of different things. The farmers have cellars, not connected with the house, for storage of vegetables. We have no tenement-houses built for more than two families

Registration and vital statistics are sent by the physicians of the township to the assessor.

There have been no contagious diseases requiring to be quarantined during the past year. There has been no general vaccination.

HARRISON TOWNSHIP. *Report from* E. E. DE GROFFT, M.D., *Sec'y.*

Our water-supply is obtained principally from wells. There are quite a number of cisterns in the township, but the water is only used for washing. The water from our wells is almost without an exception pure and soft.

Nature has provided for nearly every town in the township a com-

plete drainage system, as our villages are situated so high that after a heavy rainfall the surface-water soon passes into mill-ponds that are in close proximity to the towns; hence we are comparatively free from malaria.

All of the houses have cellars, and many of them are used for the storage of potatoes.

The prevailing disease during the past summer has been dysentery, the physicians of the township having from ten to twelve cases each. In the majority of cases, however, it assumed a mild form.

Hog cholera has been prevailing to an alarming extent during the past year, some farmers losing as many as thirty or forty hogs, or their entire herd, while others have escaped. Even where sanitary or prophylactic means have been employed, the disease seems to have assumed the same intensity, and as yet no remedy has been found to cure or prevent the spread of the malady; and, as there is a possibility of some hogs that are killed for the market being more or less contaminated with the disease, especially where they have been kept in the same pen with those that have died, it is the sense of this Board that the same precautions should be employed by the State Board in hog cholera as in pleuro-pneumonia among cattle, in order to eradicate the evil, as one is as hazardous to the public health as the other.

LOGAN TOWNSHIP. - *Report from* S. B. PLATT, *Secretary.*

Source of water-supply for drinking purposes entirely from wells from twelve to twenty-five feet deep; water generally hard.

No system of drainage is employed, other than natural water-courses. The usual water-level is such as to secure dry cellars. There is much swamp in township, consisting of cedar swamp and tide marshes. No malaria this year.

No sewers. Cesspools and privy vaults generally open sides and bottom. Some are being made tight, and nearly all new ones are being made tight when built. Contents generally taken out in winter or early spring, and used for fertilizer.

Local Board has adopted a sanitary code, the circulation of which has been of advantage and benefit by calling attention to sanitary matters which would otherwise escape attention.

Returns are made once a month, with few cases of neglect.

Board organized so that when necessary, contagious diseases can be quarantined at once.

Physicians report the best health this year since the Board was organized, four years ago.

Two complaints of nuisances this year, which were abated at once on notice.

SOUTH HARRISON TWP. *Report from* S. F. STANGER, M.D., *Sec'y.*

Our water-supply is obtained from wells and cisterns. It is hard, and during a part of the summer it is very offensive and not fit for drinking. I suppose about one-fourth of the inhabitants receive their supply of water from both wells and cisterns, the remainder from wells and the mill-pond which runs through the village.

As to drainage, it is obtained by running tile from our houses to the near-by streams; otherwise we would have our cellars half full of water, especially when there are heavy rains. We have had some malaria during the year.

Our houses generally have cellars, and are used largely for storage of vegetables. There is no yearly house-to-house inspection.

WASHINGTON TWP. - *Report from* DR. C. B. PHILLIPS, *Inspector.*

During the past year there have been two complaints made to the Board of Health, but upon notice to the owner the nuisances were abated.

The health of the township has been good, there having been no local epidemics of any kind, and but few cases of contagious diseases, and very little malaria.

WOOLWICH. - - - *Report from* DANIEL LIPPINCOTT.

Cesspools are the usual termination of drainage-pipes, and are not, as a rule, cemented. As a general thing, an old barrel sunken in the ground, or a hole filled with stones and covered with dirt, answers as a receptacle for all kitchen drainage. The privies do not get the careful attention which is necessary for the best sanitary condition of the localities in which they are situated.

No enforced vaccination of school children. Inhabitants wait until small-pox occurs in some surrounding town or city.

Measles, chicken-pox and malarial troubles have been epidemic

throughout the township. Mild in type and no deaths have been brought to my notice. Malarial troubles are on the decrease, although they have sprung into existence quite liberally this fall.

HUDSON COUNTY.

JERSEY CITY. - - *Report from* C. J. ROONEY, Jr., *Clerk.*

The strict requirement of the Board as to the reports, and the prompt and rigid exclusion from the schools of children from infected houses, are having apparently very satisfactory results, especially in the case of scarlet fever. When a disease seems to threaten to become epidemic among the pupils of a school the Board advises the Board of Education to close and cleanse and disinfect the building.

Three school buildings were thus shut up for a time during the year. The Board finds a ready co-operation in these matters on the part of the educational authorities.

Prompt measures of vaccination and isolation certainly prevented the spread of small-pox from the twenty-one cases reported. In several cases the disease was traced to immigrants, and in others was brought from New York.

The Inspectors have caused a great improvement in the methods of cow-keeping throughout the cities, towns and townships.

An establishment for boiling dead animals, long complained of, has been removed to the extremity of Kearny township, in the swamp district, and no new complaints are received.

All the slaughter-houses in Jersey City are now kept in much better shape than formerly; all have been caused to adopt methods of sewerage and cleanliness.

Many sunken lots have been caused to be filled.

HUNTERDON COUNTY.

BETHLEHEM TOWNSHIP. - *Report from* J. S. LINABERRY, M.D.

The water-supply is by springs, bored and dug wells, and cisterns. Drainage and sewerage are accomplished by Nature's work. Refuse

and excreta have heretofore been taken care of, so as not to contaminate the air. There are eight school-houses in this township. The water is supplied by cisterns chiefly. We had a scourge of measles last spring, but not of a very malignant type. A few cases were rendered fatal by complications. Otherwise we have had no particular malady, until about three weeks ago. Diphtheria broke out in the West End school, and is of a serious character. The school-house is located near a mill-pond, upon a low, flat piece of ground. The disease from that time presented the unmistakable laryngeal diphtheria, which appeared to resist all remedies.

CLINTON. - - - *Report from* L. B. BAKER, *Inspector.*

No prevalent disease in this borough, with the exception of malaria. The tendency to increase of same is expected in the future.

EAST AMWELL TOWNSHIP. - *Report from* P. C. YOUNG, M.D.

Undoubtedly we have had a larger per cent. of sickness for the year ending October 1st, 1887, than for some years past. The most predominating diseases have been measles and summer diarrhœa. The measles assumed an epidemic during the later months of winter and early spring, extending pretty much throughout the whole township. The cases were comparatively mild, save a few cases which were complicated with pneumonia.

The summer diarrhœa was mild, but persistent in its course. A great many families were affected by it. The cause, I think, was the excessive heat. The general health of the township at present is very good.

HOLLAND TOWNSHIP. - *Report from* F. A. DALRYMPLE.

We have been afflicted with no epidemics, excepting one of measles in the upper end of our township, the corner bordering on the Musconetcong creek and Delaware river. Have had some diphtheria, not epidemic. Malaria continues to complicate most of our diseases. Our drainage is fair. Our Local Board of Health is in good working order. All notices emanating therefrom are respected and attended to.

LAMBERTVILLE. - *Report from* H. B. KITCHIN, *Inspector.*

The people depend principally on cisterns for water-supply. We have about forty wells within city limits; nineteen of which are on the public streets, the balance on private property. We also have a public water-supply, furnished by a private company, which is used by several families. The water is soft. It sometimes has a bad odor in warm weather, and is often discolored after heavy rains, but upon examination it has been found to be pure. The water is supplied by Swan's creek, and no sewage empties into it above supply. The pipes are frequently cleaned.

We have no sewers; the system in use here is surface-drainage. Most of the houses have dry cellars. Very few cases of malaria during past year.

Cesspools with open bottoms are used; they are emptied by a person under the direct charge of the Board, and the contents removed beyond the city limits. Excreta disposed of in a like manner.

No person is allowed to keep hogs without the consent of the Board.

There are no slaughter-houses within the city limits.

Our school buildings are in good sanitary condition; heat and ventilation fair.

No prevalent disease during past year; a few cases of diphtheria and scarlet fever.

Dr. Larison, the President of our Board, recommends that the State Board supply the Local Boards each spring with a circular for distribution.

LEBANON TOWNSHIP. - *Report from* THOS. H. CAREY, *Inspector.*

The Township Committee during the year purchased a "poor-farm," to which all those requiring assistance from the public have been removed. The house was repaired, an addition built, the surroundings put and kept in good sanitary condition, and everything conducive to the health and comfort of the occupants has been done.

Vaccination, as a rule, is looked after by the parents.

The prevalent diseases, outside of common ailments, were scarlet fever, measles, diptheritic complications, membranous croup, typhoid fever and cholera infantum.

Scarlet fever appeared early in the fall and lasted till spring. It was of mild type, and hence easily managed.

Measles broke out during the winter, and did not disappear till late in the spring. It was one of the worst epidemics of this fever that ever visited us. Young and old were alike attacked by it.

Diphtheritic complications were frequently met with, but gave no serious trouble, save in connection with membranous croup.

Several cases of membranous croup occurred. This was by far the worst disease to handle. Almost every case complicated with diphtheria, proved fatal.

Cholera infantum was easily managed, except in the quite young and in the "badly nourished." Very few cases in these two classes survived the attack.

Typhoid fever again paid its annual visit. Junction, as usual, was its objective point, although a few cases occurred outside. In almost every instance it ran a course entirely different from the ordinary type. Malaria or bronchial trouble, and sometimes both, complicated nearly every case.

Considering the nature of the diseases in our midst, our mortality was not so large. No deaths resulted from measles, and but very few from scarlet and typhoid fevers. Several died from membranous croup and from cholera infantum, especially when met with as stated above.

The annual visitation of typhoid at Junction is indisputable evidence that the cause is still in existence. Where it abides is the question. If the germ theory be correct, there is a spot where these germs are propagated.

A few citizens during the summer asked an investigation. No Board of Health being in existence, the matter was taken hold of individually, until the next meeting of the committee. No organization was effected. Having no authority to act, there was, consequently, very little done toward stamping out the trouble. The willingness of the citizens to act in conjunction with us in removing everything that might foster the disease, should stimulate earnest efforts on our part to rid the place of this unwelcome visitor.

RARITAN TOWNSHIP. - *Report from* JOHN H. EWING, M.D.

Last spring, for perhaps two months, we had an extensive epidemic of measles. During August and early September rather a larger number of cases of dysentery and diarrhœa than usual, but few fatal

cases. For the rest of the year the amount of sickness has been about as usual.

The township votes for the Health Board $50, and that has been sufficient to meet all expenses.

TOWNSHIP OF TEWKSBURY. - *Report from* C. W. APGAR.

Malarial diseases are frequent, especially in the form of typho-malarial. There have been several cases of this disease in different parts of the township.

Houses generally have cellars, which are used for the storage of vegetables.

There are probably twenty-five houses occupied by more than two families.

There are a great many children that have not been vaccinated.

MERCER COUNTY.

CHAMBERSBURG. - *Report from* JAMES H. TINDALL, *Inspector.*

We have no sewers. We have several cesspools. Some are cemented, while others are built with open bottoms, and are emptied by the scavengers.

Slaughter-houses are regularly visited by the Board and its officers and kept in a clean and healthy condition.

In reference to manufactories harmful to health, the Board has had continual complaints of Oscar Niedt & Co.'s soap manufactory, situated on Broad street. Some people in the locality claim it to be a nuisance, and others claim it is not at all objectionable. The smell arising therefrom is certainly at times very obnoxious. The Board frequently visits the place and prevails upon the owners to keep it as clean as possible, which they do.

The prevalent diseases of the year have been diphtheria and malaria. We have had about twenty cases and about six deaths from diphtheria during the fall.

LAWRENCE TOWNSHIP. - - *Report from* ISAAC B. BAKER.

Know of no nuisances.

Board well organized. Ordinance passed after model of the State Board.

MILLHAM TOWNSHIP. *Report from* JAMES E. CLINTON, *Secretary.*

There is no system of drainage other than the usual water-level, but we have ample facilities for draining the whole of the township. We have a few bad swamps around us, and we tried every reasonable means to have them drained this fall, but it seemed as though our appeals had but little weight. The swamp which I refer to commences in the rear of the Hamilton rubber works, or the southwestern part of the township, and continues on the line of the Pennsylvania railroad, which crosses the boundary line at the Assanpink creek in the eastern part of the township.

Cesspools are coming to be a regular place for sewering into. Some are bricked, with open bottom the same as wells, and many are sewering into wells on streets where they all use city water.

TRENTON. - - *Report from* WILLIAM CLOKE, *Secretary.*

The Board of Health of the city of Trenton has pursued the vigorous and effective administration of sanitary government that has marked its career as organized under the present law. It has maintained a vigilant oversight, and promptly abated all nuisances and sources of foulness that threatened danger to the public health. So far as it has been able, laboring under the serious disadvantages of having no system of sewerage in the city, it has protected and maintained the health of the citizens. The death-rate, however, is larger this year than last, despite the most zealous efforts of the Board and its efficient Health Inspector. Last year it was 14 in the 1,000. This year, from January, 1887, to January, 1888, it is 18.31 in the 1,000, estimating the increase in population since June, 1885, when the last census was taken, at 3,614, or a total of 38,000, which, I think, is likely to be under the real mark. The increase in the death-rate is due to the rapid growth of the city, and the consequent pollution of the air and water by the accumulated waste and earth pollution of a large population, without sewers to carry off and innocuously dispose of such waste.

Before my next report is sent in there is every reason to believe that the city will have at least begun a comprehensive system of sewerage. A plan proposed by Engineer Hering has been adopted. An ordinance has been passed providing for an outfall and certain intersecting sewers, the right of way has been purchased, and the

engineers are now preparing the plans and specifications in readiness for advertising for proposals. During the past year the Board abated over a thousand nuisances of various sorts, arrested and collected the penalty from several offenders, and has the city under a thorough system of inspection and government. The Board has just completed the careful preparation of a complete new code, which is very comprehensive and elaborate, covering about all the subjects of sanitary government over which the State law gives Local Boards control. This code has passed its final reading, and is now the law of the city.

WEST WINDSOR TOWNSHIP. - *Report from* JOHN C. YARD.

We have very little to report from this township this year. We have had no complaints made. The health of the people has been very good—no epidemics of any kind. There has been somewhat of malaria in the township. As to animals, from the inquiries I have made there have been very few losses this year, and no prevalent disease amongst them.

WASHINGTON TOWNSHIP. - *Report from* JOHN B. YARD, *Sec'y.*

The health of our township is good. It is a healthy part of the county. No very filthy places in it. Everything that is unhealthy is promptly removed with very little trouble.

MIDDLESEX COUNTY.

NEW BRUNSWICK. - *Report from* A. V. N. BALDWIN, *Secretary.*

The city water-supply has been in a very good condition.

The pressing need of the city is increased sewerage, only about one-fifth of the city being sewered; but even this plan does not meet the approval of the Board of Health, as it empties into a slack-water. The remaining portions of the city have no means by which to get rid of waste water, &c.

The Board of Health, in combination with the citizens, are making an effort to extend an efficient system of sewerage in other portions of the city.

All of the unpaved, and many of the paved streets, are in a bad sanitary condition.

During the past year, ashes, more or less mixed with garbage, have been put upon the unpaved streets, making a condition of things far from salubrious.

The houses are mainly in a fair sanitary condition, and but very few poor tenement-houses exist.

There is not enough care taken in the separation of the garbage from the ashes. The Board has called the attention of the public to this matter, and although there has been some improvement, there is still room for further care.

There have been several cases of pleuro-pneumonia in districts outside of the city during the past year, but owing to the prompt action of the State authorities we hope that the disease has been arrested.

We have no slaughter-houses or abattoirs at present within the city limits.

Our factories are all in a very fair sanitary condition.

During the past year the Board has passed new ordinances defining more clearly nuisances, and providing for their abatement; also ordinances relating to contagious diseases, domestic animals, disposal of offal, vegetable matter, material removed from cover-basins and sewers, ashes, slops and liquid house-water, privy vaults and cesspools, and defining their mode of construction.

A system of house-to-house inspection has been inaugurated by the Board, and will in the future be productive of much good. During the summer the same system of disinfection of the streets as given in the report for 1884 has been carried out.

The expenses of the Board are very small compared with the size of the city, being only $500 per annum. The Board gratefully acknowledges that this sum is now paid directly to the Treasurer of the Board to be used as emergency may require.

During the past year the health of the city has been good. The number of cases of contagious diseases has been less than in a number of years. This has been particularly noticeable in regard to cholera-infantum, there being fewer cases and of a milder type. It would be premature to ascribe this decrease to the disinfection of the streets, as the disease varies with the season; still it is reasonable to inquire how far this result has connection with such sanitary measures.

The number of cases of typhoid fever has been small, notwithstanding the reports of the daily papers.

The Board records with sorrow the loss it has sustained within the past few months in the death of Dr. Thos. L. Janeway, the former Inspector of the Board, who, by his zeal, wisdom and experience was one of its most useful members.

SOUTH AMBOY. - - - *Report from* A. V. APPLEGATE.

Houses generally have cellars, few use basements.

The ground is sandy, so the cellars and basements are always dry.

We have no Health Inspector now. He did not attend to his business, so the Board dismissed him from the work and attend to it themselves.

Water is taken from spring and well, and is good all the year round. No sewer. The town is gradual descent to the bay, 100 feet to the mile. Street is not paved. Laid out on the map by John Perrine, Jr., are two parks.

All public health laws have been strictly enforced by the Board of Health.

WOODBRIDGE TOWNSHIP. *Report from* EPHRAIM CUTTER, *Pres't.*

Cesspools are used to some extent, and generally cemented, and are emptied by the owners of the property.

There has been some disease among horses in the township; supposed to be spinal meningitis.

Slaughter-houses are inspected.

The cemeteries are properly managed and kept in good order.

We adopted a code of ordinances in June last past in relation to the public health, and to prevent nuisances.

Vital statistics are returned regularly by the assessor to the State Board of Health.

There have been no contagious diseases to require any quarantine.

The Board has expended for sanitary purposes during the year the sum of $76.85.

During the year the Board was compelled to institute legal proceedings against the Board of Chosen Freeholders of the county, to compel them to abate a nuisance, consisting of ponds of stagnant water caused by them in the erection of a bridge; but, fortunately, the nuisance was voluntarily abated by them before the suit had proceeded to a final hearing.

MONMOUTH COUNTY.

FREEHOLD TOWNSHIP. - *Report from* W. J. McCLURE, *Secretary.*

During the past season a brick cesspool was built at a reasonable distance from, and to receive the waste water of the well in front of, the court-house, which has proved a decided benefit, as there are no complaints, as formerly, of a foul nuisance, caused by deposits in the gutters on Main street.

In addition to this, the freeholders are about completing a substantial arched culvert across the lower portion of Main street, an improvement which was very much needed, and which will prove an advantage over the previous one, and remedy defects which have heretofore existed.

There has been a general compliance with health ordinances, and nuisances are not suffered to exist after the attention of the Board has been called to them.

MANALAPAN TWP. - *Report from* WM. C. BROWN, *Chairman.*

Surface-drainage and under-drainage. Malaria frequent. Sewerage, earthen pipes; fall, two feet to the hundred; size, two rows ten-inch pipe; outfall, raceway; whole length of sewerage, four hundred feet.

Assessor made inquiry as to diseases of animals, and found no prevalent diseases.

School facilities are kept up to the ordinary standard.

The Board is governed by the law in regard to vaccination.

Diseases of malarial origin are prevalent.

MATAWAN. - - *Report from* RICHARD BEDLE, *Secretary.*

The health of both township and borough is in a reasonably good condition; no epidemic up to this date. As for drainage, ours is a natural one. One or two complaints about stagnant water have been made and the evil has been removed.

MILLSTONE TWP. *Report from* GEORGE M. DAVISON, *Chairman.*

The water is supplied by sunken wells and clear running streams.

There have been no prevalent diseases of man or animal, and but one or two cases of typhoid and malarial fever.

ASBURY PARK. - - *Report from* RANDOLPH ROSS, *Clerk.*

The past year has been unattended by any remarkable occurrence in this borough affecting the general progress of the health-protection movement. Troublesome opposition to the established methods of the Board of Health has ceased to exist, and the public sentiment which now sustains the Board has its strength in the demonstrated value to all residents of efforts to place the borough in a condition of sanitary safety. Aside from routine work of regular inspections and attention to complaints, the examination of wells has been the special undertaking. Samples of water are taken by the Inspector and delivered to the chemist for analysis as fast as the convenience of these officers permits. The samples are gathered from all premises on which a well is in use for domestic purposes, each street being taken in succession. The chemist's results are compared with the Inspector's observations, and when a well is condemned it is permanently closed. Thus far about 25 per cent. of wells examined have been found to be polluted. The Board hopes to examine every well in the borough before the expiration of the present year.

The public supply of water has been abundant during the past year, and its quality is excellent. The number of water takers is now 375. This seems satisfactory, considering that the water-works have been in operation only two years, and that the total number of dwellings in Asbury Park is about 850. The water is taken entirely from artesian flowing wells, about 420 feet deep. Additional pumping capacity has been recently purchased, and no doubt is now felt that the supply will continue to be sufficient. The sewer system is faithfully and unobjectionably attended to, and no trouble or annoyance is experienced on its account. The number of sewer connections is now 679. We are proud to be able to say we have no leaking cesspool in the borough, and only seven of these abominations of any description. The seven which we have are built of brick and cement, and are supposed to be water-tight.

During the early spring a very extensive but mild epidemic of measles occurred in this vicinity. Seventy-seven cases were reported, none of them being fatal. Eleven cases of diphtheria have occurred during the year, and five of these died. There were also six cases of scarlet fever, but no deaths. No typhoid has occurred during the year.

Total number of cases of communicable disease, 94. Total number of deaths from communicable disease, 5.

This Board has caused an examination of the kerosene oil sold by every merchant in the borough (39 samples), and all samples were found to flash above 100°.

During the year we have sent 271 written notices, directing attention to violation of the sanitary code. It is the custom of the Board to offer free vaccination every year, and this was done as usual last January. We now have a record of 671 vaccinations and re-vaccinations, which have been performed gratis by the Board. The Board has thus far received no financial aid whatever from the borough, and a formal and earnest demand has now been made for funds. Three thousand dollars per annum is needed to conduct the operations of the Board, as the following estimate will show:

Executive officer	$1,500
One Inspector, one year	650
Three Assistant Inspectors, two months	300
Counsel fees	200
Clerk	100
Printing	100
Analysis	50
Sundry expenses	100
	$3,000

The street record books are kept corrected, and they are continuing to be the source of ready information for every-day reference. They are condensed histories of conditions and changes on all premises in the borough. We trust that in addition to the present aid given by this record, that a perusal of their pages will stimulate our successors by showing to them our early imperfections, and by enabling them to judge of the benefits of sanitary improvements as to the death-rate.

RED BANK AND SHREWSBURY. *Report from* JOHN H. COOK, *Sec'y.*

A deep well which goes through the marl to the water-bearing sand from Middletown hills, furnishes a public water-supply. This public water is very pure, the well being supplied by the same subterranean stream as that which supplies the artesian wells of Asbury Park, Ocean Grove and other places along the coast.

The country is drained naturally by slopes of land. The town has several short sewers to carry off rainfall.

The streets contain nothing detrimental to health. Refuse is prohibited from being thrown in the streets. The town has no public grounds.

Houses are generally in good sanitary condition. A thorough inspection of all houses within the town was made by Inspector last spring, and all sanitary defects were ordered remedied, and the orders carried out.

Ordinary refuse, paper, dirt and general refuse are carted out of town and thrown in various gullies, &c. Decomposable refuse from grocery stores, excreta, &c., are carted away and used as fertilizer. A little of the refuse from groceries, &c., is thrown in dumping-places where it is desired to have the land filled in.

Contagious diseases are quarantined when in the opinion of physicians it is necessary. No ordinances concerning vaccination, though almost without exception persons within the borough are vaccinated.

The above applies also to the township of Shrewsbury. Red Bank is the main town of the township, the others being minor villages. W. J. Child, Health Registrar of the township, desires me to add this note.

UPPER FREEHOLD. *Report from* H. G. NORTON, M.D., *Inspector.*

The past year has not been marked by any severe epidemics.

Whooping-cough was quite prevalent through the spring and early summer.

A little typhoid fever has shown itself in Imlaystown again this year, but only a few cases, and they of a mild type. As the sanitary condition is the same as before, we think the absence of fever may be due to the unusually wet summer and high springs.

A little diphtheria has broken out in Allentown, but as the physicians there are taking every means to prevent its spreading we do not anticipate any large number of cases.

We have noticed a fatal disease among sheep, seemingly parasitic, for which we gave tartar emetic and turpentine. This caused the sheep to void a great many worms, and cured all sheep so treated, whereas others, not treated and presenting the same symptoms, invariably died.

MORRIS COUNTY.

DOVER. - - - - - - *Report from* JOHN S. GIBSON.

Refuse carted away weekly by corporation.

One slaughter-house in town limits, which is about to be removed by order of Board of Health.

RANDOLPH TOWNSHIP. - *Report from* JAMES S. MELICK.

The health of the township for the past year has been good. Measles were quite prevalent during the summer, but not fatal, as few if any deaths resulted from it. A few cases of dysentery; but one death occurred from it, and we had a few fatal cases of diphtheria. The greater part of our township is in the city of Dover, and they have a Board of Health of their own, and you will receive a report from it.

MONTVILLE TOWNSHIP. - - *Report from* ASA T. COOK.

Malarial fever; not as much this year as some years previous.

OCEAN COUNTY.

BRICK TOWNSHIP. - *Report from* HENRY A. BENNETT, M.D.

Upon a careful retrospect the Board of Health in this township are enabled to see wherein it has accomplished much good during the past year.

No epidemic has made raids upon the township, nor any section thereof, for more than two years. Early last spring, the township physician was notified of a case of scarlet fever that had been imported from an adjoining district in Monmouth county into Runyon's school district, in our township. As there was some danger of infection the school was closed for a while, and all danger was thereby averted. A few cases of typhoid fever have been reported; one of these being in Point Pleasant, the others being scattered throughout the rural districts. Diphtheria was introduced into one family, two miles from

Point Pleasant, having been brought there by a fisherman from Seabright. Five members of the family were stricken by the dread disease, one dying. Stringent measures were adopted, and by the co-operation of the attending physician the trouble was stopped.

Since our last report, Lakewood has erected water works that furnish a full and pure supply of water.

At Bay Head, an artesian well has been bored, which at present is yielding an ample supply.

The health matters in the borough of Point Pleasant are very rigidly governed. A very comprehensive code of sanitary rules has been adopted, and is being enforced with care.

It is true that some people oppose, with a certain amount of strength, all efforts to quietly regulate sanitary matters, but it is also true that slowly, but surely, their prejudices are being swept away before the plain results for good which the Board of Health can and does secure.

DOVER TOWNSHIP. - *Report from* EMANUEL H. WILKES.

The year has been one of general healthfulness. We have no contagious diseases, and the health of our people has been generally good. Early in the year we had a fearful scare about the appearance of the typhoid fever, that seemed at first to alarm the entire township, and for a while checked the business of our village. But, although we were troubled with some sixty or seventy cases, yet these cases were so skillfully and successfully treated by our physicians that, of all the cases, only six that have died can be traced directly to the fever. I am happy to say that this scare has had a beneficial effect upon the local officers and the people of the town in general.

The sanitary condition of the village has been wonderfully improved. The old jail has been thoroughly renovated. The old water-closets and pipes have all been torn out and new ones substituted. The drainage of the town has been very much improved, so that all surface-water is carried away by our increased sewerage system, and whatever has seemed to be hurtful to the public health has been removed. [Be sure to lock the door after the horse is stolen.—*Secretary.*]

We append also a special brief report by Dr. R. L. Disbrow as to typhoid fever at Toms River, and in that vicinity.

"TOMS RIVER, N. J., January 28th, 1888.

"In reply to yours of the 11th instant, respecting the typhoid fever at Toms River last spring, I have to inform you that the first cases occurred in the central part of town, but were not confined to any part of town or locality.

"I don't think it was brought to town, and we physicians here were unable to trace it to water or local causes. There were in all about forty cases of fever in and about Toms River. Of this number, nine cases had distinct typhoid symptoms. The other cases were of a remittent and irregular form of fever and scattered through this section. I saw no cases of hemorrhage myself, but learn of three cases, two of which died.

"There were seven deaths in all from fever, and four or five from typhoid fever.

"Dr. Schureman, in speaking of a 'fever essentially typhoid,' has reference to an irregular form of fever that prevails throughout this part of Ocean county, namely, Berkeley and Dover townships.

"We undoubtedly have had during the past year more fever than usual for us.

"I inclose a report of the cases under Dr. Schureman's treatment, which he very kindly made out for me a few days ago. The cases under my treatment and observation were generally similar to those of Dr. Schureman. Very truly,

"R. L. DISBROW."

EAGLESWOOD TOWNSHIP. - - *Report from* C. R. COX, SR.

Our little township has been very healthy for the most part this past year. Some few complaints of nuisances at Beach Haven were made, which were removed on notice by one of the members of the Health Board.

JACKSON TOWNSHIP. - *Report from* CONOVER MATTHEWS, *Sec'y.*

Our land needs but little drainage. There are no places of any size to require sewerage. All the houses are in as comfortable condition as could be expected. Through the township quite a number of children have been vaccinated, but there are no arrangements made to isolate cases of a contagious character. There have been no contagious diseases in our township. There is every indication of good health. Our timber is principally pine; that makes our section healthy.

LACEY TWP. - *Report from* MARCUS KENYON, M.D., *Chairman.*

A set of ordinances was enacted by the Local Board in June, 1887, and they are now in force.

The executive officer of the Local Board is empowered to quarantine or isolate, if required. Vaccination is only partly kept up.

PASSAIC COUNTY.

MANCHESTER TOWNSHIP. *Report from* WM. D. BERDAN, *Sec'y.*

We have health laws and regulations for the township, a copy of which is sent herewith.

As a Health Board we take hold of any contagious disease as soon as it makes its appearance, and stamp it out as quickly as possible. Last February, in the village of Haledon, there was one case of small-pox. We ordered the Haledon school closed at once, and had the doctor go to all the schools in the township, and vaccinate all the children. There was a general vaccination through the whole township. We had the Haledon school fumigated; had the house where small-pox patient was, under quarantine, and as soon as patient was well had the house fumigated, and that was the only case of small-pox we had.

No diseases have prevailed to any extent the past year. There have been two cases of typhoid fever in the township.

PATERSON. - *Report from* WM. K. NEWTON, M.D., *Inspector.*

As to cemeteries and burials we send herewith a report on the cemeteries in the city limits.

The following report embraces all the facts:

In accordance with the resolution adopted July 12th, directing this committee to investigate the burial of human bodies in the cemeteries within the city limits and to report the sanitary bearings of the question, we would report as follows:

There are within the city limits the following cemeteries:

(1) Cedar Lawn Cemetery; (2) the Totowa burying-ground at Totowa and Redwood avenues; (3) the old grave-yard at Water street; (4) the cemeteries at Sandy Hill.

The first we dismissed from consideration, as it is well and properly located, and the superintendence is such as to merit commendation.

The Totowa burying-ground has not yet been investigated.

The old grave-yard at Water street is abandoned and neglected, and no interments have been made there for a number of years. As most of the families there represented have disappeared, or have lost all interest in their departed, it is not probable that any more interments will be made there.

The cemeteries at Sandy Hill, comprising the new and old Catholic, the new and old Presbytertan, the Methodist, Reformed, Baptist and Episcopal, were more thoroughly examined, but special attention was paid to the condition of the Methodist, Reformed and the new Presbyterian, reserving for the future a more detailed examination of the others. A map of these Sandy Hill cemeteries was prepared by the City Surveyor, Mr. Ferguson, by our direction.

At the first meeting of this committee Mr. John Inglis, representing the Cemetery Protective Association of the Methodist Churches, attended and put us in the possession of much valuable information, acting on which the Health Inspector was directed to begin action against certain undertakers for violation of Section 51 of the Sanitary Code in that they did not inter bodies to the depth required by the code. Complaints were accordingly made against Chas. M. Rutan, Wallace Graham, William Massaker and Jacob Odell.

Rutan was convicted on trial, Massaker entered a plea of guilty, Graham was convicted on trial and Odell was discharged by the Recorder because he was not a responsible person, being only a laborer and not answerable for the offense charged.

Our investigation revealed the fact that at least 55 per cent. of all the dead of our city were buried in these Sandy Hill grave-yards, making a total each year of about 700 bodies, not including those brought from Passaic and other towns.

It was ascertained that many of the lots had been sold to undertakers by the owners, they having removed the dead to other cemeteries, and the chief source of trouble was the sale of these lots to undertakers.

The following measurements, made under the direction of the committee, will show how the land has been overcrowded and to what depth burials have been made:

In lots owned by C. M. Rutan bodies were found at the following depths: 14 inches, 19 inches, 26 inches, 24 inches, 30 inches, 17 inches and 12 inches.

In lots owned by A. R. Rutan, 24 inches, 23 inches, 24 inches, 30 inches, 36 inches, 24 inches, 24 inches, 17 inches; body of Harriet E. Paul, 24 inches; 30 inches, 21 inches; body of Kate Houman, 14 inches; 33 inches, 20 inches, 26 inches; body of Henry Rust, 36 inches; 31 inches, 34 inches, 35 inches, 24 inches; body of Elwood Elmore, 34 inches; 29 inches, and varying depths from 12 inches to 40. About forty graves in these plots were measured.

In lots owned by Hiram Gould the following measurements were made: 14 inches, 19 inches, 21 inches; body of Peter Allarton, 36 inches; 36 inches, 34 inches, 24 inches, 18 inches, 36 inches, 36 inches, 14 inches, 18 inches, 24 inches, 16 inches, 16 inches, 16 inches, 14 inches. Other measurements, to the number of thirty, in the lots were made, but none were equal to the requirements of the code.

In the lot of John Slater an adult is buried only 14 inches deep.

In the lots owned by W. H. Massaker the following measurements are recorded: 20 inches, 18 inches, 30 inches; the body of Isaac Kirkham, 24 inches; 32 inches. Other measurements, to the number of fourteen, from 12 to 34 inches.

In one of the lots owned by A. R. Rutan not only has the ground been

filled with bodies, but the surface of the plot has been raised about 15 inches above the surrounding ground.

In many instances a very offensive smell came from the shallow graves, and we are informed by the Superintendent that after heavy rain storms the stench is very strong.

The ground in many places is so filled with bodies that there is no room for more, and even the paths and roadways have been invaded and bodies there interred.

The above very superficial investigation will serve to acquaint you with the condition of the Methodist and Reformed cemeteries.

We also found that no system for the collection or examination of burial permits existed at these grave-yards, but that the bodies were interred without any registration by the authorities of the cemeteries, if any such there be. In fact, we learned of many instances where burial had been made at night without the necessary legal permit and without even permission from the lot-owners. In one case the lot-owner was surprised to find his plot occupied by bodies that did not belong to his family.

Your committee would make the following recommendations :

1. The rigid enforcement of the code.
2. The Registrar of Vital Statistics to note on the death certificate the name of the particular ground where interment is to be made, and to refuse a burial permit when such information is withheld.
3. That permits for burial be refused in cemeteries where no authorized person is present there to receive such permit.
4. That all permits granted for interments to all cemeteries, except Cedar Lawn and Holy Sepulchre, be returned to the Registrar properly indorsed, after the burial.
5. That the Registrar report to the Board at each meeting the places of interment where burials have been made and the number at each.

Your committee would desire the privilege of continuing this investigation, to report at the next meeting any further results that they may obtain.

WILLIAM K. NEWTON, *Chairman*,
THEODORE Y. KINNE,
JOHN R. LEAL,
Committee.

SECOND REPORT.

In addition to the measurements mentioned in the previous report the following were found not to be of the proper depth :

Methodist Cemetery.—In one grave the body was only 12 inches deep, in two 18 in., in two 19 in., in two 24 in., in three 26 in., in one 27 in., in one 30 in., in two 36 in., in four 37 in. A very few were found of the lawful depth.

Reformed Cemetery.—One 7½ in., one 14 in., four 15 in., one 16 in., three 18 in., three 19 in., two 20 in., one 9 in., one 12 in., one 23 in., nine 25 in., one 26 in., six 28 in., six 27 in., ten 29 in., seventeen 36 in. Few of lawful depth.

New Presbyterian—One 7 in., one 14 in., four 15 in., one 16 in., three 18 in., three 19 in., two 20 in., one each 21, 22, 23 in., seven 24 in., eleven 30 in., three 31 in., three 32 in., thirty 36 in.

The following were not previously examined :

Old Presbyterian.—One 9 in., one 13 in., two 14 in., four 18 in., six 20 in., ten 24 in., three 25 in., three 26 in., nine between 27 and 36 in. No custodian, and many interments made without authority. At least 20 graves under bushes, trees and brush without mound or other means of identification. Bodies buried without regard to lot boundaries, and with less regard to public decency. The portion abutting on Vine street has been dug away for building purposes, exposing many remains.

Old Catholic Cemetery.—Seldom used, but many interments in recent years not properly made. Graves are found 12 to 34 inches deep. Eleven were found not of proper depth. Several disinterments made and excavations not properly filled. Pieces of coffin cast on the ground add to the disgraceful appearance of the place.

New Catholic Cemetery.—Over sixty measurements, with following results: Four graves 9 inches deep, three 11 in., two 12 in., one 14 in., one 15 in., one 17 in., two 18 in., two 19 in., fourteen 21 in., three 25 in., three 27 in., eight 30 in., nine 35 in., six 36 in. The greater portion of this ground is overcrowded and no more interments should be allowed therein.

Episcopal Cemetery.—About fifty graves examined. Four were only 9 inches deep, two 10 in., two 11 in., three 12 in., three 20 in., seven 22 in., two 23 in., six 30 in., five 34 in., ten 35 to 36 in. In one lot three bodies were only 9 to 12 inches under ground. In one lot containing 128 square feet twenty-six bodies are interred, some not one foot under ground.

Baptist Cemetery.—In very bad condition; fences destroyed, headstones broken and scattered around. Used for a sort of common for the people living in the vicinity, and foot-paths from street to street are worn. Under these paths were found bodies only 12 inches beneath the surface. About twenty-eight graves were examined and the measurements were but a repetition of those given above.

It is difficult to say which cemetery is in the most unsanitary condition, for each seems to rival the others in some one extremely bad feature. A common practice of some undertakers was to sell a grave to two or three persons and to bury one body on top of another. In one case a grave had been sold three times in six years to different persons, each thinking that he had sole use of it. The discovery by a woman that a grave was decorated with flowers not put there by her led to the discovery that her husband had two strangers buried on top of him. In the Reformed and Methodist cemeteries some of the paths and roadways have been invaded by the undertakers and graves have been sold and bodies interred in these paths. One road in the Reformed cemetery has been completely filled with the bodies of infants, many only 9 to 12 inches under ground. In many cases where graves have been made vacant by the removal of the original occupant to another cemetery, the place has been seized and made to do duty for a second time as a place of interment. In many places the bodies have been so tightly wedged together that scarcely any space remains between the coffins. The morals of the community are assailed by these unguarded cemeteries, for they are used as places of resort by night prowlers for immoral purposes, and not only is the health of the people living in the vicinity endangered by the stenches of the superficially buried bodies, but they are also annoyed by the shameless conduct of persons who frequent these grounds at night. The trees and underbrush allowed to grow in these neglected places should be cut away, if not by the lot-owners, then by the city authorities. These facts are mentioned with the hope that the Christian churches that own and are responsible for the condition may be stimulated into activity and be forced by public opinion to apply the proper remedy.

Are the Sandy Hill cemeteries dangerous to the health of the city?

1. For a number of years bodies have been buried with but a thin covering of earth, and as a consequence the dangerous gases from the putrefying

corpses, instead of being absorbed by the earth, as would be the case if the burial was of sufficient depth, are given off to poison the air.

2. Too many bodies have already been interred in a small area. The total area of these cemeteries equals 22.32 acres; of this about 7 acres are taken up by roadways, paths, spaces between lots and unsold lots, leaving about 15 acres available for burial purposes. By a careful computation, based on accurate data, we may state that 20,444 human bodies have already been buried in these 15 acres, and this number is being augmented by some 700 new burials each year. These figures show that at least 1,373 bodies have been interred in each acre of ground, and in some places about 1,654 bodies are in each acre. Now, in the case of the Weehawken cemetery, recently decided by the Chancellor, it was considered a good enough reason for investigation and regulation when less than that number had been buried in an acre of land. The great mass of decaying corpses in these grounds is of itself a positive danger to the health of the city.

3. Another objection to the maintenance of these cemeteries is based on the fact that there is no method of supervision or superintendence. There is no person in attendance to receive burial permits or to see that the laws are properly observed, hence there is no check on illegal interments. It is possible at present for burials and disinterments to be made without permission. For this reason alone we consider the advisability of refusing permits for these places, at least until some authorized person could be placed in charge.

4. There is no protection to those who have acquired title to lots, for their rights are so often invaded.

Taking into consideration all the facts at our disposal we are forced to the conclusion that these Sandy Hill grave-yards are a menace to the health of our people and are in such an unsanitary condition that radical and sweeping measures are required lest the public health be immediately imperiled.

Aside from sanitary considerations, it may be said that the present state of these cemeteries is a burning disgrace to the city, and especially to those Christian churches that are legally responsible for this condition. Were it not that we are more or less influenced by the rights and demands of many honest and respectable lot-owners, who keenly regret the terrible state of affairs, we would advocate the immediate closure of the grounds, and the prohibition of any more burials, but this course we are willing to postpone until some less severe measure is considered.

Who is responsible for the disgraceful condition of these cemeteries? We have intimated that the churches who own ground are directly and legally responsible, and this statement is based on the facts given below and on the opinion of the City Counsel, who has thoroughly investigated the legal bearings of the question. By the terms of the deeds granted to the below-mentioned churches, the land was to be used forever for burial purposes only, and in accepting these deeds the churches assumed full care and custody forever. It may be argued, that where lots have been sold, that all the rights and responsibilities pass to the person accepting the deed. This is only partially true, for the paths, roadways, unoccupied places, the fences and the general condition of the cemetery, as a whole, still remain to the churches granting the deed. This responsibility then, they cannot escape. The small price paid originally for the land, nor the many years that have elapsed since the purchase, cannot release them from their legal and moral obligations. It seems reasonable, then, to look to these churches for the needed relief and to hold them to their obligations.

The deeds granted were in the names of the following churches, and they or their successors must be held to a strict accounting:

1. Trustees of the First Presbyterian Society of Paterson.
2. Trustees of the First Methodist Episcopal Church, now Cross street.
3. Trustees of the First Reformed Dutch Church of Totowa.
4. Trustees of the First Particular Baptist Church, now First Baptist Church.
5. Trustees of St. Paul's Church of Paterson.
6. Trustees of the Roman Catholic St. John's Chapel.

It may be said that the price paid for the land by these corporations was merely nominal, from $150 to $450 for many acres of ground, and it is reasonable to suppose that no little profit was made by selling burial plots, hence a portion of the receipts should willingly be expended to redeem the grounds from the present bad condition.

The following recommendations are offered, with the suggestion that they are warranted by the above report:

1. The adoption of an ordinance limiting the number of bodies that may be interred in a given space.
2. The present ordinance to be amended so as to conform to the State law.
3. The passage of an ordinance requiring all undertakers and those having charge of burials to make a return to the Board of Health, properly signed by those having charge of the cemetery, that the burial was according to law.
4. It is the opinion of this committee, which is supported by that of the City Counsel, that the churches which received these grounds for city purposes and sold lots therein, are responsible for the general unsanitary condition of the places, and this committee would recommend that it be authorized to go before the next Grand Jury and procure the indictment of these corporations for maintaining a public nuisance.
5. The committee also recommends that this Board apply to the Chancellor for relief in the premises.

T. Y. KINNE,
WM. K. NEWTON,
J. E. LEAL,
Sanitary Committee.

In accordance with these instructions the committee went before the Grand Jury and the following presentment was handed in:

Passaic Oyer and Terminer and General Jail Delivery. September term, A. D. 1887. Passaic county, to wit:

The jurors for the State of New Jersey in and for the body of the county of Passaic, upon their oath, present that the cemeteries and grave-yards situated in the Fourth and Fifth wards of the city of Paterson, in said county, and known as the Sandy Hill cemeteries, are a nuisance, dangerous to the health of the people of said city, an annoyance to the people living in the vicinity of said cemeteries, a menace to the morals of the city and a disgrace to those church societies and corporations owning the grounds and responsible for the shameful condition of affairs there existing. For a number of years bodies have been there buried with a thin and insufficient covering of earth, and as a consequence the dangerous gases from the putrefying corpses are given off to poison the atmosphere. More than 20,000 bodies have already been interred in these grounds, and this number is being increased each year by some 700 new burials. In some of these cemeteries no less than 1,600 bodies have been buried in each acre of ground.

The rights of the lot-owners are not protected, and in many instances bodies have been buried on top of those entitled to a place in lots.

The roadways have been invaded and many bodies buried in them. Beside this, these places have no custodian or keeper. The brush and trees have been allowed to grow without attention, and hence afford places of concealment for the night prowler, the lewd and the lawless.

By the terms of the deeds granted to the below-mentioned churches the trustees are responsible for the disgraceful and dangerous condition of affairs:

Trustees of the First Presbyterian Society.
Trustees of the First Methodist Episcopal Church, Cross street.
Trustees of the First Reformed Dutch Church, Division street.
Trustees of the First Baptist Church.
Trustees of St. Paul's Church.
Trustees of St. John's Roman Catholic Church.

This presentment is made with the hope that these corporations shall apply the proper remedies and thus avoid rigorous prosecution in the future.

This Grand Inquest would also call attention to the fact that many undertakers of this city are responsible for burying the dead an insufficient depth not warranted by law, and among them we may mention the names of Charles M. Rutan, William H. Massaker, Wallace Graham and John F. Smith, which have come to our knowledge.

WILLIAM B. GOURLEY,
Prosecutor of the Pleas.

WILLIAM L. BAMBER,
Foreman.

A true copy.
WM. M. SMITH, *Clerk.*

What action may be taken in the future cannot be now stated.

A new sanitary code was adopted this year, a copy of which has been sent you.

The mortality reports are now made up by the Sanitary Committee.

Scarlet fever has been very prevalent, but the death-rate is low.

SALEM COUNTY.

MANNINGTON TOWNSHIP. *Report from* WM. H. ACTON, *Secretary.*

Water supplied by wells and cisterns, mostly by wells. Few cisterns are used for drinking. Water mostly hard.

There is no system for drainage or sewerage. Cellars, as a general thing, are dry. Few swamps in the township. Malaria is not frequent.

No known disease prevalent. A few cases of swine plague have been brought to notice in the spring, but not as bad as several years previous.

OLDMANS TOWNSHIP. - *Report from* W. ALBERT JUSTICE.

The people depend on wells altogether for water. A good many cellars have water in them in winter and spring, in lower part of township.

Drainage and sewerage is, I think, like it is in most country districts—no expense gone to, and no particular trouble taken to dispose of it; kitchen slops and dish-water generally in back yards, pig-pens, at bottom of lots, and privies, or, when they can be put off no longer, in some hole in the ground, and hauled in some back field. Of course there are exceptions; we have people who are very particular about such things, but they are the minority.

The people have taken great interest in schools within the last fifteen years, and the change in school-houses is surprising; every district in the township is now supplied with a good, comfortable one, and mostly well ventilated.

PILESGROVE TOWNSHIP. - *Report from* C. H. RICHMAN.

Complaint has been made to the Board of Health during this season on account of canning factories throwing refuse in the streams. The matter was reported to the State Board. After inspection by said Board the parties promised to remedy the matter another year.

On account of sickness in the public school last spring, the Local Board thought it advisable to take a sample of the water of well used by the school and forward it to the State Board for analysis, which was reported to be unfit for use. Since then the well has been closed and unused.

UPPER PITTSGROVE TOWNSHIP. *Report from* J. N. GRAY, *Sec'y.*

Water-supply for drinking and stock purposes principally from springs and wells, and for power use from the streams taking their rise within the township.

A natural drainage, as perfect as can anywhere be found, owing to the rolling character of the land.

Swine cholera has prevailed to considerable extent in different localities throughout the township among swine; several farmers having herds of thirty, forty and fifty head, losing all but two or three. No disease among cattle is reported this year.

No epidemics; merely diseases incident to the season. The community remarkably free from any ravaging disease. A few cases of diphtheria in a mild form are noticed.

SOMERSET COUNTY.

BEDMINSTER TOWNSHIP. *Report from* WM. B. SUTPHEN, *Sec'y.*

The health of the township has been good. The Board have had complaints made to them, but of not sufficient importance to require Board meetings. A notice from the Chairman or Secretary has had the desired result.

Our sanitary expenses have consequently been light.

BRIDGEWATER TWP. - *Report from* JOSEPH B. SMITH, *Secretary.*

The water for Somerville and Raritan is furnished by a private company. More than one-half of the houses take it. The water is clear, no iron or other taste; it is soft, and is good at all seasons of the year. No sewage above the point of supply.

There is no system of drainage, only private drains; most of the cellars are dry. No swamps, and very little malaria.

Houses generally have basements or cellars. About forty tenement-houses of more than two families.

There are a number of private drains. About one-half of the houses connect with them. Some cesspools are cemented, and others are built with open bottom or sides. They are emptied with wagons, and the contents are taken and mixed with dry earth and used as fertilizers.

No prevalent diseases among animals this year. Assessor inquires each year as to losses of animals and as to contagious diseases.

A few cases of fever and diphtheria occurred in the township during the last summer.

Our Board has adopted a code, and finds it a great help towards the protection of the health of the people.

HILLSBOROUGH TWP. *Report from* W. H. MERRELL, M.D., *Sec'y.*

As to prevalent diseases, ulcerated quinsy again prevailed extensively last winter. Quite a number of cases of pneumonia also were found.

Through August, summer complaints, comprising diarrhœa, dysentery, cholera infantum, &c., largely existed. Also during the later summer months malaria again visited us. The number of cases was not very large, but more than for the past two years. These were along the river. Often it had been over its banks.

Also, I report several cases of bilious remitting fever. These are now in progress and are running a severe course. In one family it would seem to be contagious. The mother was away in Hunterdon county taking care of a married daughter who had this fever. She came home and in three weeks the fever began to come on. There had up to this time been no fever in that neighborhood. In about two weeks one daughter got down with the fever and in another week a second daughter.

MONTGOMERY TOWNSHIP. *Report from* WILLIAM OPPIE, *Sec'y.*

There has been no disease prevailing as an epidemic during the past year, and the general health of the township is exceedingly good.

The Board of Health has had no complaints for nuisances during the past year.

Our school-houses are in good condition, but I think their ventilation might be improved. We have three slaughter-houses and they are kept in clean condition, and are not a nuisance to the localities in which they are situated.

I would say, further, that the returns of vital statistics, particularly births, have not been as well attended to by some physicians as they should be.

NORTH PLAINFIELD. - *Report from* J. H. CARMAN, M.D.

In submitting the first annual report of the Board of Health of the borough of North Plainfield, I am pleased to state that since its organization, January 17th, 1887, the Board has paved the way to future and important sanitary reform. Though hampered and embarrassed by a want of funds, it has passed a code of health ordinances and sought to interest the population in the all-important subject of

sanitation, and, with one or two exceptions, found them appreciative and willing to co-operate in any measures conducive to public health. It has provided, by ordinance, for the protection of the water-supply and for the proper cleansing of cesspools, privies, &c., and the disposal of the contents thereof; has prohibited the maintenance of all nuisances, and, in order to suppress epidemics, requires the reporting of all contagious diseases and the quarantining of the same. The Board is also anxious to establish some system for the removal of garbage, which is sadly needed here, but, with an empty treasury, has not had the pleasure of seeing its desires carried out.

The health of the borough the past year has been very good, the only epidemic being one of measles in the early spring, of a mild type.

There are a few cases of diphtheria here now, which are being quarantined. This record seems remarkable when one considers how closely the water-supply and the cesspools are connected. The water is derived from driven wells, which, with a few exceptions, are rather shallow, and in some cases but a few feet from the cesspools. True, the water in general is of a very good quality, and few diseases, perhaps, have as yet been traced directly to it; but there is a time coming when North Plainfield will awaken from its present dream of safety to the dread reality of disease. Together with her twin sister, Plainfield, this township has long, and perhaps justly, been known as the "Colorado of the East," but unless a change comes o'er the spirit of her council's dreams, she will soon have to yield this proud distinction to some wiser or more fortunate town, and fall in line with other insalubrious places. Statistics prove this to be a salubrious locality, but on the principle that "an ounce of prevention is worth a pound of cure," we are sadly in need of water works which would give us all pure and uncontaminated water, and a system of sewerage to avert the evils the cesspools threaten us with.

WARREN TOWNSHIP. - *Report from* JOEL CODINGTON, *Inspector*.

Springs, wells, and cisterns constitute the whole water-supply. The land is drained by blind ditches. There is no sewerage. The cellars are dry. There are no swamps, and no malaria. Sanitary expenses are paid by Town Committee.

SUSSEX COUNTY.

ANDOVER TOWNSHIP. - *Report from* GREEN C. COOK.

No system of drainage. The village being located on elevated ground, all surface-water from heavy rains, &c., is soon carried off through surface-drains emptying into a live, running stream passing through the village.

The streets and sidewalks are kept clean. Garbage and refuse matter not allowed to accumulate to an extent detrimental to good health.

Houses all have basements or cellars. Where used as cellars they are used for storage of fruits and vegetables during the winter season; all decaying matter removed in early spring, when a general house-cleaning is next in order.

Cesspools and privies are receiving more careful attention in the manner of construction. The manner of constructing the few cesspools that are in existence is being condemned. Such as an excavation a few feet from the dwelling, partially filled with stones; completely covered with earth; no outside means for the escape of the noxious gases therein generated; no trap in the pipe leading from the kitchen sink to the cesspool, consequently the only means of escape for such disease-breeding gases are through the pipe, and discharging into living apartments of the family.

BYRAM TOWNSHIP. - *Report from* C. R. DAVISSON, *Inspector.*

The general water-supply is from springs and wells varying in depth from ten to thirty feet. All the water is more or less impregnated with iron.

Refuse of all kinds is generally used for farm manure.

Public health laws are well observed.

Vital statistics are not promptly returned, and it gives some trouble, but we get them when we notify of neglect.

We have a medical member to look after the sanitary condition of the township.

STILLWATER. - - *Report from* DR. CHARLES V. MOON.

The assessor informs me that he has made diligent inquiry if any cases of disease in animals have occurred during the past year, and he reports none.

The past year has been one of unusual health in the township—strikingly so with that class of diseases we call malarial. The cause, in my judgment, is the unusually heavy rains during the summer, thus keeping the wells, springs and streams full and flushed.

VERNON TOWNSHIP. - - *Report from* H. H. DEKAY.

Unusual good health has prevailed in this township the past year; no epidemic of any kind and no complaint to the Board of Health.

WALPACK TOWNSHIP. - - *Report from* MARTIN HULL.

The health of the people of Walpack township has been good for the past year; no epidemic of any kind, or contagious disease, very little cholera infantum and dysentery. No complaints were made rendering any action of the Board necessary.

Water-supply is derived chiefly from springs and wells, mostly hard water. A few depend on cisterns.

No malaria.

Houses all have cellars, which are largely used to store vegetables. No house is occupied by more than one family.

No slaughter-houses in the township.

WANTAGE TOWNSHIP. - *Report from* NEWMAN HALL, *Clerk.*

Water-supply is chiefly from wells and springs—no public supply. In this village the vaults and wells are situated close together. The wastes from kitchens are thrown on top of the ground, and I cannot see what there is to prevent an outbreak of typhoid fever at some future time.

As to drainage, there is no system. Cellars are generally dry. Extensive swamps along the Wallkill and among the foot-hills of the Blue Ridge in the north of the township, but the chief product of

them this year has been myriads of mosquitoes; in fact, the oldest inhabitant never saw the like.

No prevailing disease. There have been no contagious diseases among cattle, unless anthrax is one. There have been a few deaths of cattle from the various forms of this disease.

Slaughter-houses are situated not less than a half mile from the village, and are now not dangerous to health.

UNION COUNTY.

ELIZABETH CITY. *Report from* A. R. REEVE, *Inspector.*

There are thirty-eight miles of sewer, brick and pipe, which empty partly into Newark bay and Staten Island sound and partly into the Elizabeth river, the latter being a temporary outlet only. We have built quite a number of sewers in the past year.

The sewers are almost entirely used. There are very few cesspools, and we build no more and are doing away with what we have.

Have had considerable diphtheria during past year, but it has almost entirely abated.

The Board of Health is organized under the recent State laws, and a sanitary code adopted and enforced.

Sanitary expenses, $6,000, provided for by city council.

PLAINFIELD. - - *Report from* ANDREW MANNING, M.D.

The general health of the city of Plainfield during the past year has been good. No serious or fatal diseases have been experienced by the people.

A mild and wide-spread epidemic of measles afflicted the city during the winter and spring months, attacking nearly half of the children. Some families were visited a second, and in a few instances, a third time by the disease. In many instances the patients were scarcely sick enough to go to bed. The mortality from this epidemic was very light.

The last few weeks of winter brought with it a few cases of scarlatina, but did not approach an epidemic, not being very general, and only a few deaths are recorded therefrom.

In March one case of small-pox occurred in the very heart of the city, but by strict quarantine and prompt vaccination and re-vaccination no other case happened.

During the first two weeks of August, the weather being very warm, and the humidity of the atmosphere quite considerable, there were many instances of cholera infantum, especially among the poorer classes, and a number of deaths occurred. The mortality, to a great extent, seemed to be confined to those who were better fed.

During the months of September and October a few cases of diphtheria were reported, with two or three deaths.

RAHWAY. - *Report from* CHARLES H. LAMBERT, *Inspector.*

Rahway, Union county, N. J., about nineteen miles from Jersey City in a southerly direction, has an area including some farm land. Ground undulating, with a good natural water-course, viz., the Rahway river, which runs through the city. Population, 6,500. Climate moderately temperate, neither too moist or dry.

Nothing special to report from either a geological or topographical point.

Water-supply abundant, both from our water works and wells. The water works get their principal supply from the Rahway river, the same being filtered before going into the pipes; they also get part of their supply from wells. The works are owned by the city and the service is what is known as the Holly system. About 600 families are water-takers. It is nearly soft. It is discolored (at times only) from refuse dye from the felting mills of Messrs. Taylor & Bloodgood, in Clark township, which also at times gives the water a slight acid reaction. The pipes are cleansed twice a year by blowing out. The river does not receive any sewage above the point of supply only as above mentioned. The balance of our inhabitants depend upon wells. Cisterns are used to some extent, but not for drinking purposes; new ones are not being built to any extent, as our city water is sufficiently soft for washing purposes.

There is very little drainage other than by the sewers. The usual water level is such as in almost every part of our city to secure dry cellars. There is but little malaria in the city, and that appears to be imported from factories, where most of the population work. Our most public streets are provided with sewers and are constructed in

such a manner that almost every part of our city receives benefit therefrom. Their grade per 100 feet averages two inches; they have no special ventilation, but should have, if network was complete; they are variable in size, from a five-feet brick to a twelve-inch tile sewer, and they aggregate about five miles in length.

The streets are all graded. We have no public parks.

Houses have generally basements or cellars. Basements are generally occupied. There are but few tenement-houses that have more than two families.

Streets are lighted with electricity, houses with gas and kerosene oil.

Sewers are generally used where available; where cesspools are used they have open bottoms. Refuse from streets is carried to the poor-farm and utilized; other excreta, such as from privies, are taken out of the city at stipulated times and utilized on farms.

We have no public markets.

No diseases of animals have been reported; there is no register kept of persons keeping horses or cows. Pigs are not permitted within the city without permission of the Board of Health, and the Health Inspector sees that stables do not become a nuisance.

Slaughter-houses are conducted in such a manner as not to cause complaint from the nearest neighbors.

There are no new manufactories; what we have are conducted in such a manner as not to be detrimental to health.

Our schools and other public buildings are well built and are in a fine sanitary condition.

Our alms-house is located on a farm on the bank of the Rahway river, is in a good condition and the inmates share in the good, healthy surroundings to their benefit. Our hospital is situated on the same grounds.

Police and prisons. Police; few are necessary. City prison is in a good, healthy condition.

No fire guards or escapes are required, as the houses are built low.

Cemeteries and burials in them are well conducted under the health laws of the State, and the rules and regulations of the common council and our Local Board of Health.

Health laws are regularly enforced by the police reporting infringements to the Health Inspector.

Registration of vital statistics is regularly enforced according to the State laws.

Contagious diseases are required to be reported and strict quarantine enforced. School children are required to be vaccinated by the rules of the Board of Education.

Sanitary expenses are paid by the Health Board, out of a fund that is raised by tax, according to the State laws.

Heat and ventilation of dwellings, chiefly from heaters and stoves.

No special disease prevalent during the year and the mortality very slight.

UNION TOWNSHIP. - *Report from* D. HOBART SAYRE, *Sec'y.*

The water-supply this year has been abundant, owing probably to midsummer rains. Last year in some sections we almost had a water famine.

There has been but little sickness and no prevalent disease. Malaria, quite prevalent last year, has this year been almost unknown. But one complaint was made to us this year, which we at once investigated, and enforced the proper sanitary methods, and the trouble complained of was abated.

The birth and marriage reports come in fairly prompt and full. The death report, owing to the fact that we have no undertaker in the township, and almost all the deaths are certified to by physicians living without the township, and by them given to other assessors and city clerks, fail in some cases to reach this office.

Under the present health law, our expenses have been nothing except such as has been gratuitous by the Board, there being no towns within our limits.

WARREN COUNTY.

HACKETTSTOWN. - - *Report from* THOMAS NOLAN, *Clerk.*

Water-supply is derived from mountain stream; originally a private corporation, but now owned by the borough. It is generally taken, but four or five depend on wells or cisterns. It is discolored after rains or storms. It is not bad at any particular season, only after heavy rains. This could be remedied to a great degree if precautions were taken. Reservoir is seldom cleaned. Pipes are occasionally drawn and washed.

We have no distinct sewerage system. Our cellars are generally dry. We have what is known as Bowers' pond, which has been and is a source of malaria, and the removal of which has been considered by a former Board of Health.

Cesspools are depended upon, and are built with open bottom or sides. Slaughter-houses are generally kept in good sanitary condition.

HOPE TOWNSHIP. - *Report from* A. L. GIBBS, M.D., *Secretary.*

The Board of Health has not been called together during the past year to act upon any complaint. During the months of February, March and April we were visited by an epidemic of measles, mostly of a mild type and none fatal.

Dysentery has been quite prevalent during the summer months, in some cases of quite a malignant type, but no deaths occurred.

Malarial fevers of all varieties have been less frequent with us than in the past ten years.

KNOWLTON TOWNSHIP. *Report from* S. H. JOHNSON, M.D., *Pres't.*

More sickness has prevailed during the past year than there has been for any previous year for some time. Last spring we had an epidemic of measles, with no deaths reported. At the same time we had several cases of pneumonitis, with a few deaths reported.

During the summer intense heat has prevailed. There has been an average higher temperature than for years. The continued rainfalls have filled wells, springs and streams with surface-water, in consequence of which, together with the intense heat, mild dysentery in epidemic form has visited the township. While cases of the disease have been numerous, nevertheless there have been but two deaths resulting in the township, so far as I can learn.

A few cases of scarlet fever of a mild type have been reported.

We have flowing through the village of Delaware a small stream, composed mostly of surface-water, whose route is very circuitous. The waters of this stream are collected from a neighboring hillside. The stream is contaminated near its source by the wash of two barnyards, while its waters by their flow through the village are further contaminated by the wash of a hog-pen and the drain of two outhouses. This nuisance should be abated. It can be done in two

ways, either by the removal of all sources of contamination or by the turning aside of the stream. The latter is the more practicable and would undoubtedly give better results to the villagers.

LOPATCONG TOWNSHIP. *Report from* JEREMIAH YEISLEY, *Sec'y.*

The Board has been called out several times to abate nuisances and in every case was successful without any trouble. The general health in the township has been good. Although there were several cases of diphtheria in the township, it did not become epidemic, and only one case resulted fatally.

PHILLIPSBURG. - *Report from* P. F. BRAKELEY, JR., *Secretary.*

Water is furnished to the town by a local corporation known as the People's Water Company. The pumping station is located about one-half mile outside of the town limits, and is pumped into a reservoir of a two-million gallon capacity. Taken by about 300 families. Not discolored. It has not either a metallic or mineral taste. The works are new, and have only been completed a few months. I have no reason to believe that the water will be any different at any time of the year.

WASHINGTON. - - - *Report from* JOHN CUSHING.

We have nothing different to report from the report of last year. Last February the scarlet fever made its appearance in the school. The Board of Health ordered the school closed and had the entire building fumigated and cleansed. There was no further trouble.

The water is supplied by a private company from a mountain stream. The reservoir is located about three miles from the town, and the water is filtered through eight feet of gravel before it enters the pipes. The water is of a good quality, with a soft, irony taste.

Drainage is not perfect. There is water in a great many cellars in the spring of the year. There is no sewerage except from three large buildings which empty into a small stream. The pipe has a fall of about ten feet to the hundred, but no way of flushing or ventilating.

HEALTH LAWS AND CIRCULARS.

HEALTH LAWS.

In addition to the general consolidated health law of the State, this Board is also placed in relation to several other laws.

Those relating to the diseases of animals have received, as heretofore, our careful attention. They are believed to be of much value to the farmers and to the industrial interests of the State. The special law as to glanders has been duly enforced. Information is given as to other diseases, and, where necessary, investigations are made. Facts as to animal diseases, their relations to human diseases and as to the determination of meat and milk-supply of the markets, fully prove the importance of such a service. We think the time has come when every city should have a careful system of dairy and market inspection. Tuberculosis, swine plague and other frequent diseases prove that there is call for this guard in the interests of public health and for the protection of the people from imposition in purchasing.

Owing to a national law which has been passed as to contagious pleuro-pneumonia, this Board, after having had the approval of your Excellency and of the Attorney-General, has arranged so as to recognize the work and services of the United States Bureau of Animal Industry, but no right of general slaughter has been granted unless the owner consents. The general government now pays for services of veterinarians and for cattle killed, but have constant correspondence and advisement with this Board.

The oleomargarine law and that relating to milk-supply continue to be under the sole jurisdiction of the efficient Dairy Commissioner. In it there is no relation to the Board except as to his own appointment and a report of the work of the year so far as milk inspection is concerned. By the law, the chemists for the examination of milk are named by the Board, but as they nor any of the deputies are responsible to us we think that their appointments should be made by

the Commissioner himself or some other authority the Legislature might designate.

In a brief statement made to us as to milk inspection he speaks as follows:

"The work of carrying out the provisions of the act regulating the sale of milk has been prosecuted with greater vigor than heretofore, the force placed at my disposal by the other laws enabling me to render more efficient and thorough services than formerly. As a result the number of cases of adulteration found has exceeded that stated in former reports. The usual routine has been followed and no change has been made in the methods of inspection as described in former reports."

The procedure under the oleomargarine law will be detailed in the Commissioner's report.

The last Legislature also conferred upon the Dairy Commissioner powers as to examinations of foods and drugs and as to the enforcement of the laws as to them. While the Board still has similar powers, the special appropriation makes it proper for us to confine our attention to evidences furnished as to adulterations which directly hazard health, while the care of those specified and commercial frauds falls into other hands. The law as to petroleum and illuminating oils has done much good. Accidents now very seldom occur from the legitimate use of kerosene oils. When these are brought to our attention they are inquired into, and in a few cases dealers in suspected oils have had their products tested. It will probably be necessary the coming year again more fully to test the degree of protection which the law affords.

The laws as to the registration of physicians and as to the returns of vital statistics are looked after as formerly. While there is no call for much additional legislation, it will from time to time occur that defects which the actual application of laws can only reveal will need to be corrected. The present Legislature has already done this.

The most important laws regulating the care of the public health are Chapter LXVIII., Laws of 1887, and the united law as to vital statistics just passed by the Legislature of 1888. While there are other incidental and important laws, these form the basis of the permanent, general and local health administration of the State. The law (Chapter LXVIII.) of 1887 has been published in pamphlet form, together with suggestions and guides as to its applications and refer-

ences to particular sections by subjects. In Circular LX. before referred to as containing the general health law of the State, we give a few model ordinances which will be found sufficient for townships. They are still to be commended as guides. Where a township is larger, and, as in the case of many, a Health Inspector is needed, one or two additional ordinances in accord with Sections 31 and 36 are needed. Since these ordinances were drawn, the Board of Health of the city of Trenton has had occasion to restate its code. J. Buchanan, counselor-at-law, of Trenton, taking the fourteen specifications of *Section 12 of the State law* as the guide, drew ordinances in the order of these sections. In the Trenton code they are covered as follows:

I. First 5 sections.
II. Sections 6 to 9, inclusive.
III. Sections 10 to 15, inclusive.
IV. Sections 16 to 22, inclusive.
V. Sections 23 to 29, inclusive.
VI. Sections 30 to 32, inclusive.
VII. Sections 33 to 37, inclusive.
VIII. Sections 38 to 39, inclusive.
IX. Sections 40 to 42, inclusive.

These are all equally suited to Local Boards in townships.

Then the other sub-items named in Section 12 of the State law as to cities, are covered as follows:

I. By Sections 52 to 56, inclusive.
II. By Sections 57 to 60, inclusive.
III. By Sections 61 to 64, inclusive.

IV. and V. are so far included in the principles of other sections, as only in very exceptional cases to need additional ordinances.

Sections 65 to 68, inclusive, define the duties of the Health Inspector. (See Section 31 of the State law.)

This code might, if necessary, be slightly condensed, but in subject-matter and in order of statement it ably and fully covers the whole ground, and as to its legal accuracy, has received the approval of other competent legal advisers. We therefore commend it, so far as known, as the best model code in the State, and shall be glad to send a copy thereof to any Local Board desiring it.

The law passed recently as to *Vital Statistics* will be found herewith. It in nowise alters the system that has been in operation for several years past. The restatement was rendered necessary by the number of separate acts, and by some discrepancies that made a part of it liable to legal criticism. The only points in the new vital statistic law that need special notice are: I. That it is the duty of Local Boards to see to its enforcement (Section 15). II. The mode of collecting penalties is made more direct (Section 15). III. It is the *privilege* of Local Boards to supply physicians with stamped envelopes for monthly returns (Section 2). IV. Undertakers, when for their accommodation, obtaining burial permits where they reside, instead of where the death occurred, must provide postage for the clerk to transmit the same to the proper locality; and the keeper of every cemetery shall keep a record of interments (Section 9).

The law has been carefully drawn by Judge Lanning, and it is believed will be found adapted to its design.

The text of the law, with some circulars relating to it, will be found further on in the report of vital statistics.

LAWS OF 1887, RELATING TO PUBLIC HEALTH.

Chapter II.—Supplement to the milk act of March 14th, 1882.

Chapter XIII.—"An act to authorize municipal corporations to contract for a supply of water for public uses."

Chapter XXVII.—Supplement to the water-supply act of March 5th, 1884.

Chapter XXVIII.—Supplement to same act.

Chapter XXXVII.—Supplement to the drainage act of March 24th, 1881.

Chapter LXVIII.—"An act to establish in this state boards of health and a bureau of vital statistics, and to define their respective powers and duties," approved March thirty-first, one thousand eight hundred and eighty-seven.

Chapter CXXVI.—Supplement to the adulteration of foods and drug act of 1881.

Chapter CXLVIII.—"An act providing for sewerage in and by adjoining cities, towns and townships."

Chapter CXLIX.—Supplement to the oleomargarine act of March 22d, 1886.

Chapter CLVII.—Supplement to act of May 5th, 1884.

Chapter CLXX.—Act as to sewers.

Chapter CLXXII.—Supplement to sewer act of March 8th, 1882.

Chapter LXXVII.—Supplement to an act of 1885 as to factories and workshops.

We have already noted the vital statistics act just passed (1888), and to be found in connection with the Report on Vital Statistics. An important act as to the control of building and plumbing in cities, just passed, is herewith printed.

LAWS OF 1888.

CHAPTER LVI.

A supplement to an act entitled "An act to establish in this state boards of health and a bureau of vital statistics, and to define their respective powers and duties," approved March thirty-first, one thousand eight hundred and eighty-seven.

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey,* That local boards of health, except township boards, shall, in addition to the powers enumerated in the act to which this is a supplement, have power to pass, alter or amend ordinances, and make rules or regulations within their respective jurisdictions:

I. To compel, prescribe, regulate and control the plumbing, venti-

lation and drainage of all buildings, public and private, and the connection thereof with outside sewers, cesspools or other receptacles, and to require plans for the same, with necessary drawings or descriptions, to be submitted to said boards for inspection and approval, and to require all master and foreman plumbers and all building contractors to register their names and addresses at the office of said board;

II. To secure the sanitary condition of all buildings, public and private.

2. *And be it enacted*, That any such board of health may, by resolution, delegate any portion of its powers to any member of the board or to any officer thereof, to be exercised only when the board is not in session, and any notice by any member of the board, or by any officer thereof, shall be notice by the board, and the person served therewith shall be bound thereby.

3. *And be it enacted*, That the conviction in prosecutions by any local board of health to recover penalties for the violation of the ordinances of said board, shall be in the following or similar form:

STATE OF NEW JERSEY, } *ss.*
County of }

Be it remembered that on this day of A. D. at in said county, defendant, was, by the Second District Court of the city of N. (or by E. F., a police justice, or as the case is), convicted of violating section of the sanitary code of the Board of Health of the said city of N. (or of an ordinance entitled "An ordinance," &c.), in a summary proceeding, at the suit of the said the Board of Health of the city of N., plaintiff, upon a complaint made by ; and further, that the witnesses in said proceeding who testified for the plaintiff, were (name them), and the witnesses who testified for the defendant were (name them); wherefore, the said court (or police justice, or as the case is) doth hereby give judgment that the plaintiff recover of the defendant dollars penalty and dollars and cents costs of this proceeding.

The said conviction shall be signed by the judge of the district court, police justice or other magistrate, before whom the conviction is had; in case of the infliction of a penalty, the amount of which is increased by the fact that it is for a second or additional violation,

the conviction shall state that it appeared that the defendant had been guilty of a previous violation of the same section of said code or ordinance; the costs in prosecutions under the act to which this is a supplement, shall be the same as costs before justices of the peace, police justices or recorders, or in district courts in other civil actions.

4. *And be it enacted,* That any judgment rendered on conviction of a violation of any section of any ordinance or code of any local board of health, by any court having jurisdiction of such proceeding, may be docketed in the court of common pleas, as other judgments recorded in said courts may be, and in the same manner, and such judgment shall, from the time of said docketing in the court of common pleas, operate as a judgment obtained in a suit originally commenced in said court, and satisfaction thereof may be entered in the margin of the docket in the same manner and on the same evidence as is now provided by law in case of judgments rendered in the courts of common pleas; and the execution issued thereon shall be of the same effect as to the property of the defendant, either of a personal or real nature, as if issued on a judgment originally obtained in the court of common pleas upon a suit commenced therein; and after said docketing, no further proceedings shall be had in the said district, police, justice's or recorder's court, in which said judgment was obtained.

Approved February 24th, 1888.

CIRCULARS.

The circulars which have been prepared or re-issued during the present year will be found in this report. We now have a series of these small issues carefully prepared and giving to physicians, to householders, to schools, to operatives and to the public generally the latest opinions and directions as to the prevention and control of disease. They are found of great service, and are largely called for by Local Boards of Health and throughout the State. There will be additions made to these as any special circumstances or new facts may seem to demand.

As they give directions to families and individuals, they should be distributed by Health Inspectors. When there is fear of an epidemic,

those relating to small-pox, scarlet fever, diphtheria, &c., and the one directing as to disinfectants should be distributed.

A few additional circulars have been issued the past year. Our list now includes most of the subjects of special interest to citizens. The list, up to No. XXXVI., inclusive, is to be found in the sixth report. Since then the issues have been as follows:

XXXVII. School and Health Circular, No. 3.
XXXVIII. As to exhibition of sanitary and household appliances.
XXXIX. To Local Boards of Health.
XL. As to the health of operatives, No. 1.
XLI. Health counsels for working-people, No. 2.
XLII. As to petroleum, kerosene, &c.
XLIII. As to annual report.
XLIV. Prevention of small-pox, scarlet fever, diphtheria, &c. —as to *vaccination*.
XLV. As to cholera.
XLVI. As to annual report (1884).
XLVII. Prevention of serious injuries to the mind, the eyes, the ears.
XLVIII. As to animals. Infectious pneumo-enteritis, or swine plague.
XLIX. As to animals. Husk, or hoose, and tuberculosis in cattle.
L. Combined circulars as to contagious diseases of animals.
LI. To Local Boards of Health.
LII. Sanitary inspection of houses and premises (inspection plan).
LIII. Pure drinking-water—how to secure it.
LIV. Laws relating to public health (replaced by Circular XL.)
LV. Sanitary survey of school-houses (inspection blank).
LVI. As to annual report.
LVII. To the physicians of the State—as to typhoid fever and diphtheria.
LVIII. Health Laws to 1885 (replaced by Circular LX.)
LVIX. Laws relating to adulteration of food and drugs and to petroleum.
LX. Circular of Health Laws to 1888.

LXI. Care of household wastes.
LXII. Drainage for health.
LXIII. Farmers' homes and their perils.
LXIV. Disinfectants and how to use them.

Beside these, we have sent, as occasion has demanded, circular-letters, as herewith printed.

We are glad to send to individuals, or for distribution by Health Boards, or in schools, any of these circulars, on application by postal.

Reprint is also herewith made of two former circulars, which have been somewhat changed and enlarged.

Circular LX., containing the Health Laws and suggestions relating thereto, is not printed with the report because of its size. It has been sent to all Health Boards and Health Officers, and can be had by any one on request.

CIRCULAR LXI.

OF THE

NEW JERSEY STATE BOARD OF HEALTH.

CARE OF HOUSEHOLD WASTES.

WHAT THE HOUSEHOLDER CAN DO WITH IMPURE LIQUIDS AND REFUSE.

In ordinary household life the refuse material for which some outside receptacle or some mode of disposition must be found can be divided into the following classes:

I. Ashes, or what remains from fires.
II. Dust, sweepings and other similar refuse.
III. Wash-water from kitchen and laundry.
IV. Bath-tub and usual wash-bowl water.
V. Secretions or excretions voided from the human intestinal or urinal tract.

We desire to consider the disposition to be made of all these by householders who cannot avail themselves of public sewers.

The first rule is never to mingle any of these by-products of life when mixture can reasonably be avoided.

I. The ash-heap is misused if it becomes a place for deposit or burial of any of these materials. While sifted ashes have an absorbent and some corrective power, if used in heaps in this way they become damp and degenerate into filth-heaps. Wet ashes cause dampness and mouldiness. Hence they are to be kept separate and dry and cleared away occasionally, as convenience and health indicate. At the spring and fall house-cleaning, at least, they should be fully removed.

II. It is a rule, as to all dust, sweepings, &c., that they should be disposed of in the kitchen range or fire. We know of many who carry the use of fire for the disposal of refuse much further. There is now furnished a close pan or heater in which peelings of fruits and vegetables and bits from all culinary operations are so dried as to be cast into the fire and add to the heat. Thus all evil effects from them are avoided.

III. The wash-waters from the kitchen and laundry are always to be looked upon as fouled waters. The soap tends to separate into its original fats, and the greases are especially prone to nauseous decompositions. The kitchen liquids contain much animal matter in the form of shreds of meat or viscera, &c. Many claim that the decompositions from these sources may become as disease-breeding as our ordinary secretions.

IV. Bath-tub and wash-bowl water, while not so impure as some other liquids as representing soap and secretions from the skin, is also to be gotten rid of.

V. The secretions from the digestive tract and its appendages for the first few hours after voidance, are, as a rule, harmless, but soon become a possible source of disease. In sickness changes are more rapid, and the material should be more promptly disinfected or disposed of. This is all the more important because the secretion may have a directly specific character, so as to impart cholera, typhoid fever or other communicable disease.

It is, as a rule, a wrong course to combine these various kinds of refuse, and still worse to convey them to the outside privy vault as a general receptacle. By a little prudence in use and a little industry they are easily disposed of. As a rule, the liquid products from an ordinary family are not enough to do any harm if disposed of on the

surface of well-drained ground. Besides the use of some of them about bushes, grapevines or trees, according to their needs, there may be near the foot of the house-lot a series of furrows or deep trenches, made with the spade or hoe, into which these can be thrown alternately. If the ground is clayey it should have been underdrained. Oats or corn sown in rows between the trenches will aid much in taking up the summer excess and in protecting from the sun. We have never known a family embarrassed in the disposal of these liquids if only some such separating and absorbing system was carried out. Different parts of the plot or trenches should be used different days. We know of no record or case where a well over 20 feet deep and 50 feet distant from a plot or trenches thus used for these fresh liquids has ever fallen under suspicion of being affected. This is quite different from ponding in cesspools.

Sometimes bath-tub or wash-bowl water can very well be discharged upon this same land. It amounts to so little on an average per day that it may generally be conveyed by pipes to a trench just deep enough to protect from frost, and covered over in winter. If undrained soils become too wet there is remedy in the use of agricultural tile or in frequently changing the terminal end of the pipe. A few feet of lead pipe at the terminus easily admits of this change.

By *not adding any of these liquids* to the *voided secretions or excretions of the* body we do not have to deal with a quantity which often becomes unmanageable from mere bulk. Where there is separate urine to be emptied from the night vessels, it, too, is easily disposed of in trenches similar to those already noted. Where there is suspicious sickness the discharges should have a separate trench, and so are easily and readily disposed of.

As a rule, the dry and the dry-kept out-house is the best place for voiding intestinal excretions. *It should never be the place for emptying any indoor vessels.* If made with leaders for draught in each of the rear inside corners, beginning below the floor and leading out at the roof, and with a slight grating or perforated bricks in the foundation for ventilation when required, there will seldom be need for the use of any disinfectant. If there is, ordinary land plaster or dry soil or chloride of lime answers an excellent purpose. It is not difficult to keep the mass dry if only there is no addition of rain-water or slops. Thus kept, it is easily disposed of in pails each month or each spring or fall. A kerosene barrel sawed into two tubs is frequently

used instead of a superficial brick vault cemented, which is the next arrangement. It is true that some ground is so porous and so acts as a filter that a vault deep enought to be kept cool, and also kept dry, will do for some time without cleansing; but there are risks from water, heat and accumulations.

It is only surprising how little real trouble or risk results from the small amount of refuse incident to household living *if only some system of separation* and disposal is carried out.

It is well worth while to adopt this orderly detail, since we have come to know how frequently families suffer from a general lowering of health or from specific diseases brought about by foul dampness or contaminations of air, water or food by organic particles and refuse. The problem is simple unless we ourselves complicate it by combining the materials unduly, so as to increase bulk or quantity, or by want of system in methods of disposal. If we add gallons of water to decomposing organic matter, we are embarrassed by the great bulk of fouled liquid thus artificially provided. If, instead of speedy disposal, it is stored until it decomposes, the complications and risks are multiplied ten-fold.

There are cases, however, where, notwithstanding the absence of sewers, it is felt to be very desirable to have additional water-closet arrangements within the dwelling-house. It is a false view as to these that we need to avail of the occasional flush of wash-bowl and bath-tubs. These closets have their own water-supply, and even where there are wash-bowls and bath-tubs adjacent they should have their own separate system of pipes and conveyance. The little that is saved by joining pipes, not only increases risk, but often so increases the quantity to be disposed of at the end of the system as to add to expense. They may go to the same point of exit outside the building, but they should be disposed of separately, as before noted.

It is always a good rule to have a man-hole or other opening somewhere in the course of the pipe after it *comes out* from the building, so as to break any direct connection if a cesspool is to be used.

This is often accomplished by having a vent-pipe connecting with the sewer-pipe and going up to the roof of the house. This vent-pipe should go up directly from the outcoming pipe, and so be on the *house side* or inside of the trap which is placed beyond it to intercept any air from the cesspool or sewer. If, however, it is desired also to ventilate the sewer or cesspool, there should also be another vent-pipe near the sewer or cesspool.

Where there is this arrangement for a water-closet in the house, and for the conveyance of its contents to some place on the rear lot, we do not need either a large or a *deep cess-pit*. It should be only deep enough to secure fall and to protect the end of the pipe from frost. A fall of one inch in forty inches for a four-inch pipe, or one inch in sixty inches (five feet) for a six-inch pipe, suffices.

As the needed fall depends upon the size and rapidity of the stream, where there is not active flush, Eliot advises a fall of one-half inch per foot inside of building; Philbrick, one inch in fifty inches; less will do outside.

A cess-pit ten feet long, four feet wide, and three feet deep, suffices for a usual family. Two years since, we had one constructed for a boarding-school in the following manner: A spot was chosen quite distant from the building. The excavation was made so that it could be covered by a simple double slant roof of boards to keep out rain and sunshine, and to be opened when desired. In winter, if need be, it can be still more covered over to protect it from the frost.

The bottom was left without cement and the sides bricked up half way, or about eighteen inches from the bottom. Into this the continuous pipe from the house water-closet terminated on the top row of bricks. The bricks should be cemented on the inside. In between the second and fourth row of bricks, at distances of about eighteen inches apart, all around, let unjointed agricultural drain tile be placed, running in a straight line several feet, according to the nature of the soil. At the mouth of each of these a usual wire basket or leaf-catcher was fitted. Thus, if the liquid rose to those points in the pit, it would be carried off. The pit should be examined from time to time, and in early or late frost be examined and its small contents removed and composted. It is not difficult to give such a structure a thorough cleansing each fall or early in the spring. With proper oversight the method proves very effectual where tight cesspools cannot be used, and where the well is not near.

The deep and hidden cesspool system should be abandoned as far as possible. Where there is too much kitchen or laundry-water for disposal on the surface or in trenches, a similar cesspool may receive this. It should be occasionally examined and any accumulated grease removed. Besides the removal of material for compost, as required, during some part of the fall or winter when the ground is dry, it is well, occasionally, to more thoroughly cleanse the sides of

the cesspool, and if need be, stop up the lower end of the house-pipe and pass a disinfecting solution in it until nearly full, and let it stand for a while and then discharge it. This would seldom be necessary, but is easily done if desired.

Nothing has here been said as to inside traps, pipes and fixtures, since the rules as to these are the same as if the contents passed into a public sewer. As so many householders in the country, in villages and in the smaller towns and cities are dependent upon receptacles of home construction, it is believed this outline will serve as a guide. The greatest embarrassment happens from the combination of different kinds of refuse, each of which would be easily disposed of if kept separate.

Where cesspools must be used, it is far better and less expensive to have two or three disconnected ones, not deep, and easily cleansed, built as we have indicated, for each variety of slop, rather than to have one great store-house for a pond of foul liquid. These simple plans may be used by any family that deems it worth while to take the trouble to avoid causes of sickness or of general lack of vigor.

These methods answer for the country and for scattered village houses where neither your own nor your neighbor's well is near, and where the population is not large. But they are not to be considered as applicable to larger towns and cities. So soon as any form of leaking distributing cesspools come to be very near each other we are in danger of polluting both air and soil.

What is practicable for a small population is often hazardous for a crowded population. Health Boards and health authorities, and not the individual, should be the judges when the limit is reached, and when fully-cemented pits and the odorless excavator or sewers are needed.

CIRCULAR LXII.

OF THE

NEW JERSEY STATE BOARD OF HEALTH.

DRAINAGE FOR HEALTH.

No question as to any locality is more important than its effect upon the *Health* of its population. Is the section of country which I have chosen for my home favorable to my own health and that of

my family? Upon the answer to this more depends than upon any other inquiry we can make as to it. There are no compensations for avoidable sickness or ill health, which secures discomfort, suspends labor, shortens the working period of our years, entails enfeebled constitutions upon our children, or actually destroys life. In the decision of this question we have come to know that we have much to do with the condition of the soil or ground beneath and about us. There must be

DRAINAGE FOR HEALTH.

There are some especial reasons why the citizens of New Jersey need to consider this subject. There is defective drainage in many sections of the State. There are spaces of land in which the soil itself is naturally too retentive of water. There are swamps, marshes and ponds, both natural and artificial. There are cities, as well as separate houses, in various localities, made damp by their surroundings. There is also a tendency to form artificial ponds or lakes for profit or ornament. Our nearness to large cities gives great inducements for manufactories, and inasmuch as water-power, if it can be obtained by ponding the rivers in their courses, is cheaper than steam-power, there is much temptation to secure or assert the privilege of storing water, even in places or localities where such obstruction involves the overflow of large portions of adjacent lands.

Besides numerous smaller areas there are three great tracts in New Jersey in which the need for extensive drainage is justly claimed. The first is the Great Meadows on the Pequest, in Warren county, which has already been so far drained as to give abundant evidence of the advantages alike to agriculture and health.

The second is the Drowned Land of the Walkill, in Sussex county, comprising about 10,000 acres, the drainage of which will depend on the removal of obstructions in Orange county in the State of New York.

The third is the Overflow Land of the Passaic river and its branches, including in all about 20,000 acres.

These wet lands of the Passaic and its branches are wholly within our own domain. The Passaic river and its branches drain an area of 750 square miles above Little Falls. In freshets there is an overflow over twenty miles up the stream in addition to the holding back of water in the subsoil during other or subsequent periods. "There

are 11,400 acres in the townships of Caldwell, Livingston, Harrison and Chatham, which are liable to be damaged by freshets, and there is an area of seventy-five square miles, or nearly 50,000 acres, the salubrity of which is affected by insufficient drainage."

Our rainfall is over forty inches a year, against a rainfall of thirty inches in Holland and twenty-six inches on the east coast of England. This means for us a rainfall each year of over 800,000 gallons per acre. Allowing liberally for evaporation from the surface, an average of 900 gallons per acre or 576,000 gallons a square mile each day reaches the stream. When there are heavy rains, if it has not free course there must be overflow and destruction to property, to health, to life.

Even these few examples of undrained lands, and smaller areas well known in various portions of the State, commend to our careful consideration whether or not undrained lands are unhealthy.

By *undrained lands* are meant those which are subject to frequent overflows of water in storms, or such as are too constantly full of water very near the surface. Ground is kept too wet in its soil or upper layers when the water in the soil cannot flow off from it, even though there is no water standing on it. It is all the worse when covered with marshes or ponds, or subject to frequent overflows.

There are at least three ways of proving that ground, in either of these ways saturated with water, cannot be healthy.

The first is that derived from a knowledge of natural processes and the uniform results of their infringement.

The second is that derived from series of facts collected by special skilled observers and the prevailing common sentiment of those who, as medical practitioners, have thorough experience and familiarity with diseases and their apparent causes.

The third is that derived from contrasts between the healthfulness of localities, for many years before and after drainage.

As we study the natural processes of life, or the relations of the ground to its contents, its surroundings and the animal life upon it, we are not without important evidence.

The chemist or physical student of earth and man can prove in his laboratory that water was never intended to be stagnant in the ground near the surface upon which animal life is to exist. He finds that the upper ground or soil is made up of animal and vegetable as well as mineral matter, and that there must be *air and water in circulation*

in it in order that plants can be fed, that decomposition can take place in a natural way, and that the atmosphere above it may be such as is fit for breathing. Ground filled to the brim with water cannot have air, and no ground can be healthy without it. The function of water sent into the ground is that of a carrier and distributer, whose business it is to circulate, and in its circulation to be followed by air, which must occupy the porous upper surface of the soil in order that plants may use their food and that animal and vegetable matters always in the soil may not decompose in such ways as chemistry and all science show is sure to produce miasms, and to affect the upper air we breathe.

While the natural decompositions going on in porous soils nourish plant-life and aid human health, the abnormal, putrefactive and irregular decompositions in water-soaked soils are always a risk to human health and life.

It is the respiration of the soil, and this alone, that, by the co-operation of air and water, keeps the upper air and soil clean—the one fit for our respiration and the other for our habitation.

Dr. Russell has illustrated the difference between the healthful processes of drained soil and the unhealthful processes of soaked soils somewhat thus: If we bury a carcass in a porous soil, not too deep, after due time nothing but the bones and denser parts remain, and no perceptible effect is had upon the air about it. But plunge a carcass of the same size in a soil saturated with water, and, instead of a clean and harmless heap of bones, we get a repulsive mass of putridity and offensive organic gases, which impregnate air, water and soil. Just such contrasts occur in the myriad processes going on in the soil. In the one case the water flows to its proper ground level and is followed by air, and those changes take place which feed the plants and purify the surrounding atmosphere. In the other case the vegetable and animal matters accumulate, and, instead of healthful distribution in the soil, they are ready, so soon as a special period of dryness or heat arrives, not to feed plants and animals in the ground, but to hurt or destroy life above it.

It is as easy to prove that such land must be unhealthy as it is to prove any of the facts of experimental science.

Equally unmistakable is the effect on temperature. Excess of moisture, even on lands not evidently wet, is a cause of excessive dews and fogs and of atmospheric impurity. Its evaporation lowers tem-

perature, produces chilliness, and creates or aggravates the injurious changes or fluctuations of temperature by which health is injured. Indeed, the effect on mankind has been so apparent that the unhealthfulness of such localities is proverbial in experience as it is inevitable by the laws of nature. There is no difference of opinion among students of nature's laws as to the insalubrity of undrained and drowned lands.

Our next evidence is derived from the large number of facts collected by careful observers.

Perhaps no one in Europe has so closely studied the effects of soil moisture or of a high and varying water level in undrained localities as Pettenkofer, the distinguished Professor at Munich. He has made special study of various diseases as related to soils, and regards undrained areas filled with organic animal or vegetable matter, not only as essential causes of many common ailments, but as the culture-beds which await the arrival of specific contagions and impart to them their destructive power.

In 1863, under the direction of the Lords of Council of England and its Medical Officer, Dr. George Whitley, a skilled inspector was commissioned to visit and investigate the worst districts of England. Over fifty districts were visited and full report thereupon made in 1864. The details are full of interest as showing the great amount of sickness of various kinds, and out of all proportion to the number of deaths which occurred from the wet conditions of lands.

Dr. Farr, for forty years the Health Statistician of England, in his twelfth report gives statistics carefully prepared, showing the insalubrity of undrained land. Thus, the mortality of Ely, North Witchford, Whittlesey and Wisbeach, in Cambridgeshire, at the mouth of the Nene, was 2.45 per cent., while that of the high parts of Surrey, Sussex, North Devon and Northumberland, was from 1.80 to 1.40 per cent.

In the International Statistical Congress at the Hague (1869) it was shown that drainage had favorably influenced the rate of mortality more than any other one measure.

Dr. George Buchanan, the chief medical officer of the Local Government Board of England, made independent and extended comparisons in several counties of England, and showed that consumption prevailed much more extensively in localities adjacent to overflowed and undrained lands.

In the eight chief towns of Scotland it has been shown that consumption prevails in proportion to dampness of locality.

Dr. Henry I. Browditch, of Boston, in the examination of 45,000 deaths from consumption in Massachusetts for ten years, and in a thorough comparison of 183 townships and many single localities and dwellings, showed most conclusively that the distribution of the disease is very irregular, and that the difference depended mostly on difference in drainage and ground moisture. The proportion of consumptives in 128 wet localities was eighty-eight per cent., and in the dry less than twenty per cent. The wet condition of the soil influenced *all that class of diseases* arising from irregularity of temperature and excessive dampness.

Dr. Edwin Snow, the veteran health officer of Providence, Rhode Island, in the close study of facts as to a pond and extensive swamp in that vicinity, arrives at the following conclusions: (*a*) All those acres of swamp would be dry ground if the water in the pond was kept at its natural level. (*b*) The high water of the pond keeps numerous swampy places and hollows in a swampy condition, and the ground-water in the vicinity so high as to make the soil wet and cellars damp and unhealthy. (*c*) In the swamps thus made, the vegetable growth is luxuriant, and as the water falls and vegetation dies we have the conditions most favorable to the prevalence of fever and ague, of which these conditions are the chief if not the sole cause.

The Chairman of the Section of State Medicine and Public Hygiene, of the American Medical Association, says: "Of all the preventable causes of disease throughout the country, defective drainage is the most prolific."

A careful comparison of the records of the transactions of the State Medical Society of New Jersey for over thirty years, and of the reports of the New Jersey Board of Health for ten years, shows the same kind of evidence as to the effects of undrained lands or of the overflow of lands by reason of artificial obstructions. This view is abundantly supported by the reports of Health Boards of all of the States and of the Province of Ontario in Canada.

It is indisputable that the common sentiment and testimony from experience of general practitioners of medicine supports the more technical and painstaking investigations which have been made. While it is often the case with the individual practitioner, that he has

not studied the causes of disease so much as its treatment, or that his knowledge has been fragmentary, or not classified and analyzed, or his experience of one disease not extensive enough for deductions, it is significant when we find, as to the relation of wet and undrained lands to ill health, a consensus of opinion such as exists on no other subject of causation in the entire range of diseases.

Whatever may be the questions raised as to the causes of variations in the prevalence of periodic fevers, their connection with undrained lands and with unnatural decompositions in or upon the soil is the common testimony of the medical profession.

Not less is it recognized that various other diseases are the result of water-soaked soils. We have already cited the evidence as to consumption and lung diseases. It is well known how the liver, the spleen and the blood itself are affected by the malarial influence. Rheumatism, neuralgia and general want of vigor are frequent results to those not afflicted with chills and fever. In this State, in the Bound Brook visitation, the severities and number of the neuralgic attacks were as marked as the chill and fever seizures.

Our third information as to the relations of undrained lands to health is that derived from the contrast in localities before and after drainage plans have been put in operation.

In the twenty-first and twenty-second reports of the Registrar-General of England we have details of the results of extensive drainage of the fens of Ely, of Wisbeach and the valley of the Nene. Comparisons for several years show the death-rate to have been greatly reduced and the hopes of the advocates of extended drainage were more than realized. This fact is all the more important because death-rate alone does not show the actual results. For loss of time by chills and fever and loss of vigor and after-effects are out of all proportion to the absolute death-rate. Thus, Peterborough Hospital in England, in the course of fourteen years had a record of 4,000 malarious cases with very few deaths directly from these. The real record reaches over a large class of diseases and impairments.

Dr. George Whitley, in his report to the Local Government Board of England, says that many districts which had been drained showed a great decrease of disease as compared with former times, and that "the decrease is attributable in very nearly every case mainly to one cause, improved land drainage."

The essay of Ashbel Welch, C.E., on "Subsoil Drainage," con-

tained in the fourth report of this Board (1880), is full of illustrations of the relations of drainage to health. Taking up in detail the returns from twenty-four towns in England, as given by the Chief Medical Officer of England, he compared the death-rates for years before and for years after drainage from those diseases believed to be affected by the stagnation of water in or upon the ground. With admirable analysis he shows that "we are fairly entitled to conclude that drying of the soil had more influence in decreasing the general death-rate than all other causes together. The good done was mainly by the drying effected."

The case of Bound Brook and its mill-dam, as detailed in the fourth report of this Board (1880), is a most convincing illustration. The whole marsh has been drained and there has not since been any re-appearance of the prevalent fevers and intermittent neuralgias.

The facts as to Rahway, before and after the removal of its mill-dams, and the great advantages resulting, were fully attested by all the practicing physicians of that day.

As a result of the drainage of the Great Meadows, on the Pequest, in Warren county, Prof. Cook's report of 1880 says: "The sanitary benefits are, if possible, more marked than the agricultural. Formerly fever and ague and other malarial diseases were very prevalent, in some seasons attacking almost every person. Now sickness is comparatively rare, and in this year, which has been marked by the general prevalence of malarial disorders, there have been very few cases of such sickness anywhere about the Great Meadows."

His last report, 1886, says physicians report that there is no more malarial disease around the meadows than there is on the uplands, and that there are no more fogs in the valley than there are on the hills. This is very different from its former condition, as given in the report of 1877. In it, Drs. Blackwell and Cook, Roe and Hartpence, who have seen much practice in the regions about "The Great Meadows" of Warren county, agree that autumnal fevers and malarial disorders prevailed there much more than in the hilly country round about, and they attributed these to the stagnant water and undrained ground of the meadows.

Dr. Blackwell says: "It appeared to me, while sojourning in the neighborhood and marking the effects of these blighting influences upon the health of the people, that I could perceive in the lessened vigor and robustness of many of the residents the results of the

insidious and baleful poison. The outbreak of malaria always occurs when the overflow leaves its sedimentary matter, and the earth itself is soaked with deadly gases and under the full influence of the autumn sun."

November, 1886, Dr. J. S. Cook, of Hackettstown, says: "I think I can truly say there has been a great decrease in the malarial diseases along the course of the Pequest since drainage was accomplished. These diseases are no more prevalent than in any other well-drained county. My own experience and the reports from other physicians confirm me in making this report."

These are but specimens of evidence by the volume which could be drawn from various reports in all the States by those who have closely watched the conditions of health before and after drainage.

What should be the result, in the study of these and similar facts by sanitarians or by Health Boards?

Every householder should be impressed with the need of securing beneath and around his home, ground in which there shall not be stagnant water, but through which there is free circulation of air and water.

Health Boards should see to it that in villages and cities where undrained streets, undrained cellars, sunken lots and the houses themselves interfere with flow of water and its evaporation, the matter of drainage is well enforced. For many a town a subsoil drainage system is more important than a subsoil sewer system.

The making of artificial ponds or reservoirs should be done only under expert advice. Here is a specimen from our last report:

One correspondent, from a township in Sussex county, says: "In several of the rude ponds formed for food fishes recently in this section, by throwing dams across running streams, overflows have been caused, and we have now many outbreaks of fever and ague, something that I had never known before, although I have lived over fifty years in this township." Many a home and some seaside resorts are injured by artificial ponds called lakes, or by some other form of interruption of water-circulation in the soil.

Great effort should be made to secure the drying of swamp and marsh lands where these are under tillage and near the dwellings of the people. Nature has its own way of taking care of undisturbed swamps where there are no accidental or artificial impediments to

water-flow. But when land is used for farming or for living upon, it must be drained alike in the interests of agriculture and health.

Where dams are made or ponds formed in the direct course of rivers, so as to cause a constant high-water level in the soil or frequent overflows near dwellings, the people are to unite for their removal as earnestly, as perseveringly, as faithfully as they would unite to maintain a high principle, or to preserve their lives, their liberty and their happiness. It is not merely the interest of those directly adjacent. It is a common interest for a common defense, an appeal to that higher law which should lead us to co-operate with each other and to protect each other in certain inalienable rights of which health and life are chief.

August, 1887.

Copies of this circular and others can be had by addressing postal to E. M. Hunt, M.D., Secretary, Trenton, N. J.

CIRCULAR LXIII.

OF THE

NEW JERSEY STATE BOARD OF HEALTH.

FARMERS' HOMES AND THEIR PERILS.

The interests of individuals and of the State at large are greatly involved in the health conditions to be found in the homes of farmers. The country must always be the base of supply for the vitality of our city populations.

The records of disease and especially of epidemics long ago led to the proverb that "cities are the graves of mankind." They at least tend so to be. Careful statistics and the close analysis of facts show that cities would cease to flourish and to maintain successful industries were it not that they are constantly receiving a more vigorous and enduring population from the country districts. More than this, farmers need, for their own success and happiness and that of their families, well-sustained and robust health.

Some take it for granted that the agricultural population will keep well without direction, and that country homes will be healthy just because they are in the country. Such is not the case. With many advantages, they have disadvantages peculiar to themselves, and are often sources of disease. Building sites are too frequently chosen in relation to the size and shape of the farm rather than from their fitness on the basis of health. For convenience the water-supply is placed in the houses, and the various outbuildings are too near it. Errors in management and in the care of personal health occur quite as frequently as they do in cities.

It is the design of this circular to point out the more common mistakes and to present ideas or references as to the best constructions and management.

The home locality should be chosen from regard to soil and surroundings. Unless the water-level in the ground is low, the cellar and the ground around it are likely to be too damp. The level of the water should never rise above three feet below the bottom of the cellar, unless for a very temporary time and after the heaviest rains. If the house is already built and there are signs of cellar dampness, there should be drainage around the building. An area made outside and the cementing of the cellar are among the means of preventing dampness in buildings already constructed. Since the rays of the sun as well as light, generally diffused, aid to dry the ground, close shade trees are to be avoided unless the soil is sufficiently dry and the trees tall, without low branches.

Roof-water should never be allowed to fall around the building, but should either be gathered in cisterns or led off from the dooryard. Cisterns should not be in the cellar.

Sunlight and air should not only have free access around the building, but into it. On pleasant days the whole house needs flushing with air. The cellar should have the same advantages.

Many diseases result from the varying degrees of cold and dampness in a house. A physician of large practice in one of the dairy districts of the State told us that he had kept account of the number of farmers who lost their wives before fifty years of age, and that in that section elderly women as farmers' wives were scarce. The household duties and the care of the dairy led to too much work in cellars and upon damp floors.

Colds, consumption, rheumatism and neuralgia often result from

such dampness and sudden changes. Where there is decayable matter we also have diphtheria and measles more severe with children.

WATER-SUPPLY.

The examination of farmers' wells convinces us that very many of them are hazardous. Large numbers are only surface wells, less than twenty feet deep, and exposed to all the evils which may arise from unclean soil. They are often located in sheds, or wash-houses as they are called, and covered with planks. They are sure to receive the drainage or washing about the kitchen or shed. After a few years the products of decay accumulate. There may be a sudden washing of the contents into the well, and an outbreak of typhoid fever or dysentery occurs. If not, there are lesser evils, and at times a lowering of the standard of health from impure water. If it were an active poison, the effects would be soon discovered, but these minor attacks upon vitality are not so easily identified. But special cases and long study of series of cases prove them to be real.

SLOPS.

No one has so good opportunities to dispose of all refuse as the farmer. Much of it can be fed to the swine or other animals. Laundry-water can be disposed of arouud trees or grape-vines. Some can be thrown while fresh upon the stable heap. Where there is a greater quantity, glazed pipes, well cemented, can easily conduct it to trenches in the garden. A cesspool is rarely necessary, but, if required, should be at a distance from the house, and so arranged as to admit of examination and of cleansing when needed.

Yet, with all the simple and safe methods, how often are vessels rinsed about the well, and slops thrown out on the bare ground or some other form of nuisance committed. To the persons themselves this is not a nuisance only because they have become used to it. Even the swill barrel is sometimes so located and so seldom changed or cleaned as to be a nuisance.

OUTBUILDINGS AND YARDS.

For convenience, outbuildings are often located too near the house, or in such relation thereto as that their underdrainage is in the direc-

tion of the house. If there is a cellar and the soil favors, there is underdrainage toward the house even where the surface slope of the ground is in another direction. All animal and all vegetable matter, and especially all animal excretions, are decayable or putrescible material, and hazardous to health unless disposed of according to the methods of nature. Fortunately the air and the ground and all growing plants hold themselves in readiness, when allowed so to do, to dispose of these. But, unfortunately, many so far disregard these laws as to allow accumulations or underground connections with soil, with cellar or with water-supply that are always a hazard and sometimes the direct cause of disease and death.

The complete removal in spring and fall is always essential, but it must be remembered that the ground beneath may become so soaked as to be filth-sodden, and thus shut out air and give rise to such vicious decompositions as are not in the ordinary course of proper decay. Fuller details as to "Pure Drinking-Water and How to Secure It," as to "Care of Household Wastes," and as to "Drainage for Health" can be found in Circulars LIII., LXI. and LXII. of this Board, on application by postal.

THE HEATING AND VENTILATION

Of farmers' homes has become a much more complicated matter than formerly, and gives rise to much ill health. The open wood-fire of former days was at least an excellent mode of ventilation. So the early forms of coal stoves made a continuous draught, and, if the draught was good, the gases of the coal were seldom discharged into the breathed air.

The gas-burner stove, while it does not need so frequent filling, and in this respect has advantage, yet, because it does not so constantly demand a draught, does not exchange the air as rapidly as the other forms. Not generally being tight in all its joinings, it often leaks out gas, and when it does is much worse than the older patterns of stoves. The open grate and the open stove are still to be commended, but where these cannot be used the base-burner must be of the *best make* as to its thorough joining, of proper thickness, and must be so frequently cleaned in its inner pipes or flues as not to have its draught impeded by accumulation of ashes. When a stove connects by a register with the bed-room above, it is generally so arranged

as that much of the breathed and devitalized air of the sitting-room goes up to the sleeping-room to be breathed over again during the night. That is economy of air, but not of health and life. The stove arrangement shown in Circular XXVIII. of this Board is well adapted for sitting-rooms.

Where furnaces are used by farmers there is still another exposure. Often, vegetables, meats, old boards and boxes, and various other things are kept in the cellar. Both moisture and heat are needed to start fermentation and decomposition. In the cellar of the olden time, whatever might have been its defects or accumulations, there was at least no winter heat, and the process was not so likely to get started. Now the cellar is warm, and if there is any such material in a state prepared for decay it is likely to undergo the process, and so taint the air.

Furnaces are generally provided with a cold-air box, the theory being that no air comes from the cellar except for the draught, while that which flows about the fire-pot of the furnace within its case, and so to the rooms, is the outside air thus warmed. The almost *universal fact* is that some air from the cellar, as well as dust from it and the fire, is also drawn in, and thus we really have cellar air. We have thus, for instance, in parts of the State, detected the sweet potato odor throughout the entire house. Peppermint or other diffusable odor scattered about the cellar is quite sure to be perceived wherever the heat goes. This is but the telltale as to the air we are breathing. While no effort should be spared to make the furnace inclosure tight, it is well to keep the celler so thoroughly clean and aired that its air will do no harm. While, as a rule, house-cleaning is better done in farmers' homes than in the city, the cellar cannot be considered well kept that has not all of its contents—barrels, boxes and all—turned out of doors each year for emptying, airing, scrubbing and assorting.

Ventilation is often a difficult matter in country houses because of the expense of artificial methods. The chimney can always be made valuable for this purpose. If there is a fire-place, even if closed by a fire-board, it allows some upward draught whenever there is warmth in any part of the chimney. Houses should, as far as possible, be built with fire-places, even where they are not to be used for fires. An opening in the chimney near the ceiling, to which a valve fixture is attached, is often of service. For the fires, and even the warm

weather, usually cause an upward draught, so that there is little danger of smoke being driven out, while a good amount of foul air is carried off. These may be arranged to work automatically or to admit of closure when desired.

When, on account of draught or cold, it is impracticable to ventilate through an open door or window, it is well to have a movable strip of wood of the same length and thickness as the lower piece of the lower sash, and three or four inches wide, which can be put in just under it. This separates the sashes midway up, and allows a current of air to enter with an upward direction. There are few days or nights that the sitting-room or sleeping-room will not bear this simple arrangement, which any farmer can put in himself. The wood-piece should be made to fit closely, and may have, if need be, a strip of rubber on its upper side. If the window is wide, the board may be cut in two and have an intermediate hinge so as to be a little more easily placed. A wire screen, while letting in air, helps to prevent draught, and so may be of use.

Some such arrangements are much needed in most country houses. For, although there is good air in the open country, in the sitting-room or in other rooms where the family congregates closely, there is often a good deal of vitiated air, which is no better for farmers, their wives or their children, than for other people.

There are some matters as to the *exercise* of farmers, and as to their foods and their habits, that need consideration. While it may seem as unnecessary to advise a farmer as it would be a letter-carrier to take exercise, yet farmers or their children do suffer a certain lack of physical training. By their forms of work, and especially by their sitting postures, more of this class than should become round-shouldered and lack breadth of chest in proportion to their general size. Fatigue, their mode of riding in wagons, and their gathering around the fire or the table at night, incline to this posture. So a dumb-bell exercise or a calisthenic exercise, which expands the chest, is not absurd for farmers' children. At least there is need of attention to form and posture.

Farmers are exposed much to alternations of temperature. It is not only the exposure of market days or the necessity of being out amid varying temperatures, and sometimes in rain and fog. Miasms tend toward the ground as readily about houses on level surroundings as they do about marshes. A man may be at work with impunity in

malarious places or impure air in the daytime without harm, yet he and his family suffer at night from tarrying long on the piazza or sleeping in the lower rooms of the house.

The body, also, sometimes suffers other alternations and alterations from undue heating or toasting alongside the comfortable fire at night, or by bed-clothing out of all proportion to the covering of the day. We once knew a farmer who never went close to the fire because he said he liked to learn to be comfortable out of doors as well as in.

Both houses and clothing are our attempts to adjust ourselves to our surroundings, but as nature has already done so much toward adjusting itself to our needs, we are to follow out this idea of adjustment. We may endure tonic coldness, but it is never healthy to remain chilly.

As to *foods and their uses* there are some cautions needed by farmers' families. The ready supply and the ready appetite are often temptations to excess. All the more because there are special periods of abundance. Amid a farming population there are three periods when the farmer's family can be counted on as patrons to the physician or as moderately out of health. These are the house-cleaning period, the ripe-fruit period, and the hog-killing period. All of these are thoroughly consistent with good health, since housework, ripe fruit and pork are all healthful. But excess of work, the over-indulgence, especially of children, in eating fruit to excess and at all hours, and the sudden influx of fat meats three times a day, are not without results.

We are not advocating over-precision of rules, for food is a relative thing, and there are days of toil when four meals are needed as much as three meals on other days. But we have seen too many cases in which the digestive powers and general health of country children have been impaired by the frequent piece-meals and the promiscuous crunching of apples, pears, melons, nuts, &c., at all hours of the day and evening.

Rapid eating, too, is very common at the farmers' table. Eating should be one of the most deliberate, orderly and enjoyable acts of life, and to this end should be the first process of training to which the young are subjected.

The many improvements in apparatus for cookery have put steamed vegetables, broiled, roasted and boiled meats within the reach of most, so that the dyspepsia of middle life once so common among farmers

need not now be frequent. While it is recognized that the lives of farmers and their families have a better average than most other lives, when we consider the special advantages of country life, and the additional aids as to hygiene now furnished by science and art, there ought to be a far less number of deaths among the growing families of our farm population, and a greater longevity among heads of families. It is too noticeable that typhoid fever, diphtheria, dysentery and other disorders of the digestive tract frequently occur in well-located farm-houses. The loss of productive labor and of productive character which the country at large sustains by the abbreviated lives of the rural population is greater than that from any other source, just because these are the most valuable lives. The foundations for all kinds of industry must be sought by giving stamina, vigor, endurance and long lives to the country populations. To this end they must take care of their own health and their surroundings, and must be aided by good Health Boards and the diffusion of knowledge. Thus their own happiness and prosperity are promoted, and they and their families add greatly to the best citizenship of the State.

CIRCULAR LXIV.

OF THE

NEW JERSEY STATE BOARD OF HEALTH.

DISINFECTANTS, AND HOW TO USE THEM.

TO HOUSEHOLDERS, BOARDS OF HEALTH, CITY AUTHORITIES, ETC.

I. *Look to the Condition of your House.*—Begin at the cellar or basement. Have nothing there that can decay or that causes foul odors. If damp, let in the air or sunlight, or drain the surroundings if needed. Each spring remove from it into the open air all boxes, barrels and everything movable. Thus the entire surface can be examined. Often dirt and mould accumulate on barrels and boxes and they need to be scrubbed. If by cleansing, by whitewash or by repeated airing there is not agreeable air, speedily use some of the disinfectants recommended.

II. *Look to the Kitchen.*—Let all sinks be kept sweet by scrubbing—by hot water poured down each day, or by use of disinfectants if needed. If outside there is an opening to the air, so that the kitchen sink is not the chief air outlet to a cesspool or sewer, so much the better. Be careful that all slops or offaling from the kitchen or laundry work are soon conveyed away, or disinfected at once, and not made to become a part of any heap or mass of impure matter. Cleanness cannot come out of uncleanness. Such things rapidly vitiate air, and discomfort, sickness or death results. Dirty water of any kind is even worse than dry filth. Secure cleanliness if you would secure health.

III. *Have the Dwelling and Sleeping-Rooms well aired each day.*—Closed closets, unshaken bed-clothing, windows open and curtains down, will not secure rooms fit to live in, or sleep in. *Flush* the room with air, and let this, with sweeping and dusting, remove the organic particles which otherwise constantly accumulate and cause foulness. Chamber slops and wash-water are very innocent if cared for within eight hours, but soon after decompose. If there are water-closets or stationary wash-basins in your house, be sure that they are not the foul-air inlets to outside cesspools or sewers. Have good traps, good outside ventilation, good caution as to smells, and use disinfectants for temporary purposes until you can remedy radical defects. Look to unoccupied rooms and the attic, so that all may be dried and well aired, and that you may secure as much coolness and ventilation above you as possible, and not have an unventilated hot-air chamber near the roof.

IV. *Know as far as you can that your Water or Ice-Supply is Pure.*—Use no water from wells where surface soil is foul or where organic matter can reach, or from cisterns exposed to foul air, as water will absorb foulness. Guard against the washing of any utensils about the well. It is, or ought to be, the *safe* in which you store up good water. If the water has any odor while heating in a glass tube, or if it becomes turbid or emits odor on being shaken, after being kept a day in a long glass bottle, half full and corked, at once suspect it. If you must use it, have it boiled, and when cool air it by pouring from one pitcher to another, and use it thus until you can be satisfied as to the purity. (See Circular on Water-Supply.)

V. *See that the Food Supplied for your Family* is in proper condition before cooking, and that it is prepared in a wholesome way. Any food taken to the sick person and not consumed should not be taken by others, but thrown away. So as to water long standing in the room. All dishes, spoons, &c., used in the room should be carefully cleansed either in boiling water or a disinfecting solution.

VI. *Look to the Out-door Part of your Home and see that it is kept in Proper Order—that no waste-water or decomposing matters are thrown upon it.*

If there is a cesspool it must not smell where it is disconnected with the house or has access to the air. If it does, it must be disinfected until radical change can be made. If there is an ordinary out-door privy have free access of air to it, and exclusion of all slop or rain-water from it. If there is odor from it, use odorless disinfectants until it is corrected. If too foul for use, cover it over with "calx powder," and have under the seats some receptacle, such as the patent pail, or a half-barrel or tub, which can be frequently removed and alternately replaced by another. A privy built above ground, with water-tight receptacle, by the use of dry earth, powdered wood charcoal, dry sifted ashes and occasionally copperas-water, is easily kept neat and clean if cleansed each spring and fall. (See Circular LXI.)

Country homes need inspection and circumspection. Their sanitary care is often greatly neglected by nice people.

VII. *Insist that your Town, if you live in one, has Thorough Sanitary Inspection.* Where persons are housed closely to each other there cannot but be evils from which the community has a right to be protected, and yet from which each one cannot protect himself. There will be householders who, from thoughtlessness, ignorance or poverty, do not secure for themselves or for others the needed sanitary conditions. Society, the public welfare, and the necessary incidents of city life require regulated and definite provisions against all those nuisances which imperil the life and health of the populace.

Insist upon systematic prevention, instead of waiting for that loss which disease always involves when it is artificial or when we are compelled to meet an epidemic hurriedly.

If your authorities do not act, move by voluntary associations, which shall exhibit the facts and so compel action.

There is no waste so great as that of preventable disease, which dis-

ables not only the sufferers, but puts a tax on labor, capital and life much more direful than a well-directed expenditure to prevent it. Epidemics are to be dreaded, but our greatest losses are from the ordinary death and sickness-rate which has a permanent base of supply in prevalent insanitary conditions, not prevented, not remedied as they should be and can be. Public health is common wealth. Can you not do something to reduce the tax levy which avoidable diseases impose upon the citizens of your city, township and State? To the degree that sickness or invalidism is unnecessary, it means hard times and ill-content. Every motive of comfort and interest requires that we plan to prevent all those ailments which are within the range and duty of our control.

DISINFECTANTS, AND HOW TO USE THEM.

Drafts of air for all floating foulness;

Dry rubbing for all easily-detached foulness;

Wiping and water scrubbing for all attached foulness. These, in most cases, admit of no effective substitution.

Submersion in boiling water is applicable to the cleansing of all garments, utensils, &c., admitting of such a method; and dry boiling heat or freezing cold will also neutralize all loose infective particles.

To disinfect a room, ship or building so needing disinfection that its contents and surfaces cannot be easily dealt with singly: Close the room or building, its windows, doors and chimneys, so as to exclude the outer air as far as possible. Vacate the house. Break roll sulphur in small pieces, place it in each room on an iron plate or metallic dish, and set this on a pair of tongs or other cross-bar over an iron pot in which there is water, or over a large box of sand, so as to avoid danger of fire from small particles of burning sulphur. Light it by a few hot coals or some alcohol poured around the sulphur and lighted. Then leave and shut the door after you. Three pounds of sulphur is sufficient for 1,000 cubic feet of space. The sulphur will convert all the oxygen of the air into sulphurous acid, and all organic particles are likely to be changed. Keep closed six hours after the burning has ceased, and then air well four hours before occupying. Clothing and bedding needing disinfection may be hung on lines and left in the room. Soiled clothing may need burning. In contagious diseases all articles used about the sick should be put in boiling water

or in some disinfectant solution before removal from the room. Most furniture is not permanently injured, but needs dry wiping and then washing off afterward.

CHLORIDE OF LIME.

A valuable disinfectant, chiefly because, if good, it contains at least 25 per cent. of chlorine, which is liberated under proper methods of use. If purchased for cities, it should be tested as to the amount. It is not overrated as a disinfectant if only its quality is known and its mode of use is judicious.

When used in solution to receive discharges it should be in the proportion of four ounces to a quart of water, enough being used to cover the material a half hour before emptied. If to be used over the surface of masses of organic material or in privy vaults, it may be mixed with common land plaster in the proportion of one part of the former to eight of the latter.

It needs slight moistening, frequent stirring, and sometimes the addition of an acid, as vinegar or common spirits of salt. The test of its efficiency is that the *odor* of it *be kept* constantly perceptible.

CHLORINATED SODA.

Usually known as Labarraque's solution, is a convenient liquid preparation, valuable for use in saucers in the sick room or in utensils. Its odor should be perceptible to strangers entering. An excellent similar solution is now in the market (Squibb's Chlo. Soda Solution.)

THE METALLIC DISINFECTANTS.

There are several of these.

The Mercuric Chloride, generally called Bi-chloride of Mercury or Corrosive Sublimate, is a most valuable disinfectant. It dissolves in sixteen parts of cold water and about three of boiling water. The addition of equal parts of muriate ammonia makes it as soluble in cold water as in boiling water and does not impair its action. It is inexpensive and effective. It does not color articles placed in it or injure their fibre. If freely used it may cause some colors to run or blankets and flannels to spot. It is safe to handle and harmless unless

swallowed. As it is a corrosive poison, it needs to be used by cautious or experienced persons. The usual solution is two drams to a gallon of water. Coloring it with a little indigo prevents mistaking it for water. It may be colored by adding an ounce of sulphate of copper (blue vitriol) to each gallon of water, and this also increases its efficiency.

Solution of corrosive sublimate should not be placed in metal receptacles, but in some form of stone pot. The action of solution of mercuric chloride on lead pipes is corrosive if continued long.

Cupric Sulphate—sulphate of copper (blue vitriol) is used with excellent effect in from five to twenty per cent. solution. One pound to a gallon of water is a usual proportion.

Zinc Chloride—chloride of zinc (butter of zinc) also has valuable disinfecting properties, and can be used in the same proportion as the former.

Sulphate of iron (green vitriol) and sulphate of zinc (white vitriol), while admitted to have value as disinfectants, are claimed by some as not reliable in those cases in which disease is due to or complicated by the presence of specific or pathogenic organism. They are valuable for the disinfection of cesspools, privy vaults, &c. The ferric sulphate, sulphate of iron (copperas), two pounds to a gallon of water, is available.

Carbolic Acid is valuable as an out-door disinfectant, to be added to the sulphate of iron solution or used separately. Because of its own odor we cannot well test its effect in correcting other smells. We should test specimens or use only Squibb's Liquid, No. 1, because sure of its strength, to be diluted by adding from fifty to one hundred parts of water according to the mode of its employment. It is seldom required if the other articles named are properly used. Carbolic acid and chloride of lime must not be used together.

Lime, plaster, charcoal, dry earth, sifted ashes, all of these have value, chiefly to be tested by the rapidity with which they correct odors. Fresh-slacked lime should be scattered in all places of foul odor. It or charcoal or plaster may be scattered over heaps emitting foul odors. Calx powder is made by pounding one bushel of dry fresh charcoal and two bushels of stone lime and mixing them, and is of great practical use.

All these substances absorb foul gases and dry up moisture, and

so help to retard decomposition, or else absorb its results. Where lump charcoal is used it may be refitted for use by reheating it.

Quicklime and ground plaster should not be used where they may be washed into pipes and form lime soap or obstruct by hardening.

In Circulars XLIV. and XLV. are additional suggestions. We append hereto the principal recommendations of the Committee on Disinfectants of the American Public Health Association, 1885–7, as to agents preferred by it and the modes of their use.

FOR EXCRETA.

(*a.*) In the sick-room:

For spore-containing material—

1. Chloride of lime in solution, 4 per cent.
2. Mercuric chloride in solution, 1 : 500. (Colored.)

In the absence of spores—

3. Carbolic acid in solution, 5 per cent.
4. Sulphate of copper in solution, 5 per cent.
5. Chloride of zinc in solution, 10 per cent.

(*b.*) In privy vaults:

Mercuric chloride in solution, 1 : 500.*

(*c.*) For the disinfection and deodorization of the surface of masses of organic material in privy vaults, &c.:

Chloride of lime in powder.†

FOR CLOTHING, BEDDING, ETC.

(*a.*) Soiled under-clothing, bed-linen, &c.:

1. Destruction by fire, if of little value.
2. Boiling for at least half an hour.

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* A concentrated solution containing four ounces of mercuric chloride and one pound of cupric sulphate to the gallon of water is recommended as a *standard solution.* Eight ounces of this solution to a gallon of water will give a dilute solution for the disinfection of excreta, containing about 1 : 500 of mercuric chloride and 1 : 125 of cupric sulphate.

† For this purpose the chloride of lime may be diluted with plaster of paris, or with clean, well-dried sand, in the proportion of one part to nine.

3. Immersion in a solution of mercuric chloride of the strength of 1 : 2,000 for four hours.*

4. Immersion in a two per cent. solution of carbolic acid for four hours.

(*b*.) Outer garments of wool or silk, and similar articles, which would be injured by immersion in boiling water or in a disinfecting solution:

(1.) Exposure to dry heat at a temperature of 110° C. (230° Fahr.) for two hours.

(2.) Fumigation with sulphurous acid gas for at least twelve hours, the clothing being freely exposed, and the gas present in the disinfection chamber in the proportion of four volumes per cent.

(*c*.) Mattresses and blankets soiled by the discharges of the sick:

1. Destruction by fire.

2. Exposure to super-heated steam—25 lbs. pressure—for one hour. (Mattresses to have the cover removed or freely opened).

3. Immersion in boiling water for one hour.

4. Immersion in the blue solution (mercuric chloride and sulphate of copper), two fluid ounces to the gallon of water.

FURNITURE AND ARTICLES OF WOOD, LEATHER AND PORCELAIN.†

Washing, several times repeated, with:

1. Solution of mercuric chloride 1 : 1,000. (The blue solution, four ounces to the gallon of water, may be used).

2. Solution of chloride of lime, 1 per cent.

3. Solution of carbolic acid, 2 per cent.

FOR THE PERSON.

The hands and general surface of the body of attendants, of the sick, and of convalescents at the time of their discharge from hospital:

1. Solution of chlorinated soda diluted with nine parts of water (1 : 10).

2. Carbolic acid, two per cent. solution.

* The blue solution containing sulphate of copper, diluted by adding two ounces of the concentrated solution to a gallon of water, may be used for this purpose.

† For articles of metal use Solution No. 3.

3. Mercuric chloride, 1 : 1,000; recommended only for the hands, or for washing away infectious material from a limited area, not as a bath for the entire surface of the body.

FOR THE DEAD.

Envelope the body in a sheet thoroughly saturated with :

1. Chloride of lime in solution, 4 per cent.
2. Mercuric chloride in solution, 1 : 500.
3. Carbolic acid in solution, 5 per cent.

FOR THE SICK-ROOM AND HOSPITAL WARDS.

(*a.*) While occupied, wash all surfaces with :

1. Mercuric chloride in solution, 1 : 1,000 (the blue solution containing sulphate of copper may be used).
2. Chloride of lime in solution, 1 per cent.
3. Carbolic acid in solution, 2 per cent.

(*b.*) When vacated :

Fumigate with sulphur dioxide for 12 hours, burning 3 pounds of sulphur for every 1,000 cubic feet of air-space in the room; then wash all surfaces with one of the above-mentioned disinfecting solutions, and afterward with soap and hot water; finally throw open doors and windows and ventilate freely.

N. B.—The only reason why the death-rate of your city or your township is over 15 to the 1,000, or why the sickness and invalid-rate is a large multiple of this, is because the population suffers from nuisances which cause or increase the mortality from preventable diseases.

PRESENT WHOLESALE PRICES OF DISINFECTANTS.

Mercuric Chloride (Corrosive Sublimate), 70 cents per pound.
Sulphate of Iron (Copperas, Green Vitriol), 1½ cents per pound.
Sulphate of Copper (Blue Vitriol), 6 cents per pound.
Sulphate of Zinc (White Vitriol), 4½ cents.
Fifty per cent. solution Chloride of Zinc, 25 cents per pound.

Chloride of Lime (in bulk), 3½ cents per pound; in packages, 6 cents.

Solution of Chlorinated Soda (Labarraque's), 10 cents a pound.

Sulphur Roll, 2½ cents per pound.

Carbolic Acid (No. 1 Squibb's), 30 cents per pound.

CIRCULAR XL. (NEW ISSUE.)

(INDUSTRIAL CIRCULAR NO. I.)

OF THE

NEW JERSEY STATE BOARD OF HEALTH.

HEALTH COUNSELS FOR WORKING-PEOPLE.

In the work of examination into various industries, with a view to determining their effect on the health and vigor of those employed in them, and upon their families, there are many points of inquiry which must be left to the judgment of the examiner.

The design of this circular is to suggest the outline of the work proposed, which may be added to as the need of each special industry may seem to demand. Where the inquiry is as to classes instead of any specified department, the usual division is—

I. Cultivators of the soil.
II. Active mechanics out of doors.
III. Active mechanics in shops.
IV. Inactive mechanics in shops.
V. Laborers—no special trades.

For inquiry into special occupations, the following points are to be thought of:

I. Occupations; deleterious by reason of (*A*) the inhalation of Dust, or (*B*) the production of (*a*) Irritating, (*b*) Poisonous, (*c*) Offensive Vapors and Gases, or (*C*) by the Absorption of Irritants through the Skin.

II. Occupations that involve exposure by reason of—

(*a*) Confined and foul air.
(*b*) Elevated or variable temperatures.
(*c*) Over-use of certain organs.
(*d*) Constrained positions.
(*e*) Sedentary life.
(*f*) Exposure to accidents.

While there are questions of importance as to cultivation of the soil and as to laborers with no special trades, since fitness of clothing, changes of climate, protection from accident, and cleanliness of the skin throughout, also concern these, yet the most important questions are those that relate to such as follow in-door occupations, or where the character of the labor causes dust and especially irritating substances to be infused into the breathed atmosphere. The conditions as to light, moisture and relative heat are also very important.

As all these are involved in the subjects of (I.) Personal Sanitation, and (II.) Factory and Workshop Sanitation, they are best classified under these.

The principal subjects as to personal sanitation are those of (*a*) frequent cleansing and rubbing of the entire skin, (*b*) good food, (*c*) clothing suited to varying temperature and degrees of moisture, (*d*) the supply of air of proper purity, and (*e*) pure water.

II. Factory and Workshop Sanitation includes the following particulars:

(*a*) The location of buildings and their foundations.
(*b*) The structure of the buildings.
(*c*) The proper protection of machinery.
(*d*) Washing or bathing arrangements.
(*e*) Heating apparatus and regulation.
(*f*) Safety arrangements for all steam boilers or generators and their connecting pipes.
(*g*) Ventilation and ventilating appliances.
(*h*) Special apparatus to remove steam, dust and gases.
(*i*) Natural and artificial lighting.
(*j*) Fire alarm and prevention apparatus, and fire-escapes.
(*k*) Removal of all waste products.
(*l*) Potable or drinking-water.
(*m*) Water or other closet arrangements.
(*n*) General housekeeping and periodical cleansing.
(*o*) Social and recreative regulations, with a view to health and its necessary moral aids.

The following outline will serve as a guide to observation and inquiry:

I. The sanitary condition of the place of labor; its locality, construction, drainage, facilities for light and air, water, heating, fire-escape, provisions for the removal of all wastage or material injurious to health; its *housekeeping* in the interest of cleanliness and comfort; modes of preventing or of reducing to a minimum all effluvium nuisances; of preventing dust, or so removing it by fans or sprinkling as to diminish its inhalation; modes of protecting from accident by machinery, or from irritating material used in the occupation; modes of supplying a sufficient amount of fresh air without draught, both in summer and winter; also arrangements for washing, dusting, &c., and sanitary inspection.

II. The sanitary conditions of the persons employed in each department; their general habits as to sleep, cleanliness, tobacco and alcoholic drinks; the kind of food and arrangement of meals; how far some head-covering or some overall is used to protect self and clothing from dust; the evidences of good or ill health as afforded by appearances and by the personal testimony of the person or of friends; the effect of the work on heredity, as also whether those whose parents or grandparents have pursued the same occupation inherited a reduced physical stamina; the amount of time lost by sickness; what complaints are most incident to the work; *tables of mortality* showing the actual deaths of those employed, or of those who had left the employment on account of ill health. Give age, sex and cause of death, &c., as in usual certificate.

III. The mode of pursuing the occupation; specifications of its various departments and the evils special to each, and the best methods of protection therefrom, and those actually used; the period or duration of labor. Is it night work alone, or conjoined with day work? are both males and females employed? if so, are all arrangements fitted for proper separation? is there piece-work? what portion of the work is proper for children, and for those of what age, sex or strength, and how long should they be employed in it? constrained or injurious positions in work; what arrangements for change of position or to economize strength and avoid fatigue; the income of various workers, so as to know how far it is a sufficiency without other extra labor or family help; what proportion of the adult workers, either male or female, are married; what the condition of the houses in which workmen live.

It would be impossible in one circular to treat of all these, but competency in the care of factories and workshops, and of those employed in them, requires a recognition of all these, and a good degree of acquaintance with plans and methods that have been devised to secure the best conditions.

What needs most to be known is that nearly every trade and occupation has been well investigated in its relation to disease and to health. Most of the offensive trades and occupations admit of great improvement.

Such a bibliography as that furnished in the second volume of Buck's Hygiene and Public Health shows how much writing, experiment and application have already been secured. Dr. Ballard's reports to the Local Government Board are full of information as to many hazardous occupations.

Thwaite's Treatise on Factories, Workshops and Warehouses (1882) is valuable. The prize essay of George H. Ireland, mechanic, of Springfield, Mass., as published by the American Public Health Association, 1885, is the most recent and important American essay on the subject.

Many valuable articles on various industries will be found in our State Reports. We make the following references thereto:

Report of the New Jersey Sanitary Commission (1886), pp. 9, 11.

Report of the New Jersey Health Commission (1874). Care of Tenements, Arts and Trades, pp. 33–38.

Second Report of the New Jersey State Board of Health (1878). Offensive Trades, p. 12.

Hatting as Affecting the Health of Operatives (Dennis), pp. 67–85.

Third Report (1879). Noxious Trades, pp. 13, 126.

Fifth Report (1881). Smoke Nuisance, p. 23; Operatives' Consumption, pp. 248–50.

Sixth Report (1882). Offensive Trades and Health of Operatives, pp. 18, 24.

Seventh Report (1883). Trades and Occupations (Hunt), pp. 160–170, 35, 129, 271.

Eighth Report (1884). Tenement Houses (Janes), pp. 53–63; Effluvium Nuisances, pp. 17–21; Occupations, p. 292.

Ninth Report (1885). Tenements, pp. 45, 61, 96.

Tenth Report (1886). The Hygiene of Occupations (Stickler, Newton, Davis, Hunt), pp. 157–200.

Eleventh Report (1887). Hygiene of Occupations (Warman), &c.

Copies of this Circular and of Circular (2), Health Counsels for Working-People, and the other Circulars, can be had on application by postal to Ezra M. Hunt, M.D., Secretary.

Trenton, N. J., 1888.

MEDICAL REGISTRY.

By the laws of this State every person practicing medicine or surgery in this State is required to file a medical diploma showing the fact, the date and the place of graduation, or to file a certificate of practice in one locality of at least twenty years. Only a diploma from a chartered medical college, and only the certificates of those who have practiced in one locality in the State, are to be thus filed.

The law is founded upon the right of the public to know that those who claim to have knowledge and skill for the treatment of disease, should be able to show some evidence that they have been educated in so critical and responsible an art. Life and death are its concerns, and the State owes it to itself somehow to protect its citizens from the trifling either of ignorance or presumption, with the health and the lives of those who seek medical aid. Many States require, in addition to this, the approval of some State Examining Board. There seems to be some occasion for this, when we find medical colleges often run as stock corporations for money-making, and professors in them who never could have passed a creditable examination at one of our best medical colleges. While many new and excellent medical men settle in this State, it is becoming noticeable that we are receiving more than our quota from colleges not regarded as well equipped for instruction. While the law does not need to discriminate between the medical sects of practitioners, it does need, alike in the interests of all well-educated physicians, and of the public, to discourage whatever is riskful to the general health of the people. There are no greater perils to the public health than incompetent physicians. Alike in the interests of physicians and patients this registry should be fully insisted upon, and due examination be made of all diplomas registered.

ATLANTIC COUNTY.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA	INSTITUTION CONFERRING DIPLOMA AND LOCALITY.
Cohen, F. P. W.	Atlantic City	Mar. —, '81	Academy Baltimore, Balt.
Campbell, Sidney A.	Mays Landing	—— —, '69	Jefferson College, Phila.
Demille, Sherman	Jeffries	Mar. —, '87	—— ——, Baltimore
Harvey, Chester W.	Atlantic City	Mar. 1, '75	Columbia College, N. Y.
Heilbrunn, Abraham	Atlantic City	Aug. 26, '57	Berlin University, Germany.
James, Henry Carroll	Mays Landing	Mar. 8, '87	University of New York.
Nice, Benj. H.	Atlantic City	Mar. —, '77	Jefferson, Philadelphia, Pa.
Waas, Jacob A.	Hammonton	Mar. 2, '83	Penna. Col. Dental Surgery.
Woods, Robert A.	Atlantic City	Feb. 23, '82	Univ. Tennessee, Nashville.
Williams, Edward P.	Atlantic City	Mar. —, '75	Columbia College, N. Y.

BERGEN COUNTY.

Best, George B.	Englewood	Apr. 15, '87	New York Hom. College.
Green, William S.	Hackensack,	Mar. 8, '87	Univ. of the City of N. Y.

BURLINGTON COUNTY.

Burchell, John G.		Apr. 27, '65	Eclec. Med. College of Pa.
Carrell, James Henry	Palmyra		
Dunlap, Mary J.	Burlington	Mar. 11, '86	Pensylvania Med. College.
Follett, William M.		Mar. 1, '73	Eclec. Med. College of N. Y.
Fithian, Joel W.	Burlington	Apr. 5, '87	Jefferson College, Phila.
French, Edward E.	Bordentown	Apr. 7, '87	Hahneman College.
Harris, William H.			
James, Henry C.			
Siggins, J. J.		Mar. 2, '85	Michigan College of Med.
Vannort, Joseph A.	Palmyra	Apr. 2, '87	Jefferson Medical College.
Woods, Robert F.	Mount Holly	Feb. 23, '82	University of Tennessee.

CAMDEN COUNTY.

Woods, R. A.	Philadelphia, Pa.	Feb. 23, '82	University of Tennessee.
Snyder, Sharps M.	1126 Broadway	Mar. 16, '65	University of Pennsylvania.
Ginner, Samuel G.		—— —, '85	Dundic Univ. of Lewistown.
Tait, Alexander		Mar. 10, '75	Hahneman.
Hinson, J. M.		Mar. 31, '86	Hahneman.
Hall, Henry M.		June 23, '60	Castleton, Vermont.
Du Pont, Wilfred		Mar. 15, '58	Med. Col. of State of S. C.
Howell, Aaron		Apr. 5, '87	Jefferson Med. Col., Phila.
Fortiner, George R.		Apr. 7, '87	Hahneman Med. Col., Phila.
Cooper, C. J.		Feb. 18, '68	Hom. Med. College of Pa.
Bennett, John Knight		Apr. 5, '87	Jefferson Medical College.
Blair, Edmund C.		Feb. 6, '82	Wisconsin Dental College.
Doron, John G.		May 2, '87	University of Pennsylvania.
Mercer, Edward W.		Apr. 2, '84	Hahneman.
Burchell, John Gale		Apr. 27, '65	Eclectic.
Johnstone, Robertus B.		Apr. 6, '87	Hahneman.
Turner, Benjamin H.		Mar. 17, '59	Pennsylvania Med. College.
Collins, William T.	451 Kaighn's Av.	Mar. 7, '57	Jefferson Med. College, Pa.
Lamb, Albert Victor		Apr. 2, '85	Jefferson Med. College.
Jarrett, Henry		Apr. 5, '87	Jefferson Med. College.

CAMDEN COUNTY—Continued.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCATION.
Edwards, Charles E.		Feb. 26, '70	Penna. Col. of Dental Surg.
Reese, Leolf		Mar. 14, '82	Medico-Chir. College.
Hoverder, J. I.	Atco	Apr. —, '84	Hahn. Med. Col. Phila., Pa.
Dewey. R. P.		June 20, '70	Eclectic Med. College of Pa.

CAPE MAY COUNTY.

Rice, Daniel E.	Philadelphia, Pa.	Apr. 4, '75	Penn Med. Univ. of Phila.

CUMBERLAND COUNTY.

Martin, William Nelson	Vineland	Jan. 1, '70	Eclectic Med. College of Pa., Philadelphia.
Appelgate, John Chew	Fairton	Apr. 5, '87	Jefferson Med. College, Phila.

ESSEX COUNTY.

Brien, Margaret J.		——, '87	Med. Electrician (no diploma, filed certificate).
Bailey, William Otto		Mar. 21, '87	Med. Eclectic College of N.Y.
Belvimger, Marie		Dec. 30, '86	Columbia Col. of Midwifery.
Babbitt, George Edward		June —, '86	Eclectic College of Penna.
Banning, Archibald T.		——, '73	Col. Med. & Surg., Cincinnati.
Bradner, W. K		Oct. 1, '75	Bellevue College, New York.
Damon, S. J.		Dec. 26, '76	American Health Col., Cin.
Disbrow, William		Mar. 8, '87	University of New York.
Ludwig, De Ulrichs Carl.		May 12, '86	Ludivico College of Bavaria.
Egerton, Margareta A.		Jan. 24, '81	Erlangen College.
Evarts, Lucy S.		Apr. 6, '86	Med. & Eclectic Col. of N. Y.
English, D. E.		May 16, '82	Col. of Phys. and Surg., N. Y.
Page, Edwards Thomas		Mar. 7, '85	Univ. Med. College, N. Y.
Fitch, Simon Thomas		Mar. —, '67	Bellevue Hosp. Med. College.
Gardette, E. B.		——, '81	Philadelphia Med. College.
Gage, Ruel Stearn		Mar. —, '77	University of New York.
Holper, George		Aug. 4, '86	Royal Bavarian Julius Maximilian University, Wurzburg.
Hayward, Maria Ann		Mar. —, '83	U. S. Med. Col., N. Y. City.
Hahn, Albert Johan		June 25, '85	Dartmouth Medical College.
Hundsen, Harriette L.		——, '87	Hahneman Med. Col., Phila.
Keene, Stephen S		Mar. 26, '35	University of Pennsylvania.
Mattison, John V.		Mar. 27, '46	Col. of Phys. and Surg., N.Y.
Middlebrook, E.		Mar. 27, '81	Col. of Rational Med., Mich.
Meyers, F. L.		Mar. 14, '87	Bellevue Hosp. Med. College.
Newmann, Theodore		Feb. 26, '84	University of Buffalo.
O'Reilly, J. H.		Mar. 14, '87	Bellevue Hos Med Col., N.Y.
Pennington, W.		Mar. 9, '66	University of New York.
Potter, Lorenzo Tucker		Mar. 30, '80	Chicago Medical College.
Roy, William Chester		Mar. 28, '87	Eclectic Med. Col, Chicago.
Schwarz, Emanuel		Mar. —, '87	Univ. of the City of N. Y.
Stubbert, James Edward		Mar. 8, '81	Univ. of City of New York.
Simpson, Cornelia S.		Apr. 3, '83	Med. Col. for Females, N. Y.

ESSEX COUNTY—Continued.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCATION.
Strang, George William...		—— —, '85	Collegii Medici Coloolivi Noui Charari.
Tiesler, Eugene		Mar. 19, '87	Eclectic Med. College of N. Y.
Thayer, Alfred T		Apr. 14, '87	Homœopathic Col. of N. Y.
Vogel, Henrietta		May 30, '87	Col. of Midwifery of Heidelberg, Germany.
Wait, George Nelson		Mar. 14, '—	Bellevue Hosp. Med. College.
Woods, R. A.		Feb. —, '82	Med. Col., Nashville, Tenn.
Washington, Walter Scott		Apr. 30, '76	Collegium S.S. Trumtatis apud Torontovenses.
Wittmann Aloisia		Aug. 30, '79	Royal Imp. Univ. of Prague.

GLOUCESTER COUNTY.

Hunt, Hait E			Eclectic Med. Col. of ——.
Hall, Henry M			The Castleton Med. College.
Iszard, Howard	Glassboro, N. J.		Hahneman Med. Col., Phila.
Diverty, Henry B	Woodbury, N. J.	Apr. 5, '87	Jefferson College, Phila.
Snyder, Sharps M	Clarksboro, N. J.	Oct. 6, '87	University of Pennsylvania.
Siggins, John J		Mar. 2, '87	Michigan Col. of Medicine.

HUDSON COUNTY.

Aldridge, Matilda H	Jersey City		Female Medical Academy of City of New York.
Allen, Charles S	New York		United Med. Col., New York.
Dean, George W	New York	—— —, '62	Metropolitan Med. College.
Doherty, John William			University of Vermont.
Deems, Francis M		—— —, '68	
Bailey, William Otto	Newark, N. J.	Mar. 21, '87	N. Y. Eclectic Med. College.
Cox, Stephen	Jersey City	Mar. 2, '87	Medical College of Indiana.
Follette, William Mann	Jersey City	Mar. 1, '83	Eclectic Medical College of City of New York.
Flower, Richard C		Apr. 30, '80	Amer. Health College, Cin.
Foerster, Francis	New York	—— —, '83	Col. of Phys. and Surg., N. Y.
Grinnell, Adaline S	Jersey City	—— —, '85	N. Y. Med. Col. for Women.
Green, Alfred F		Mar. 3, '85	Medical College, Atlanta, Ga.
Geyer, Victor			Freiburg Univ., Germany.
Herzog, Alfred	Hoboken	Mar. 8, '87	University of New York.
Harding, William L		Mar. 9, '60	University of New York.
Hayward, Maria Ann		Mar. 9, '83	U. S. Med. Col., N. Y. City.
Kaemmerer, Charles	Hoboken	Mar. 10, '75	University of New York.
Lingshem, Anna M		Dec. 30, '51	Pennsylvania Med. College.
Muttart, Alder C		Mar. 8, '87	Univ. of the City of N. Y.
Meeker, George F		Feb. 7, '76	New York Eclectic College.
Newell, Jennie W		Apr. 19, '87	Female Medical Academy of City of New York.
Nichols, Harry F	Hoboken	Nov. 3, '87	New York Hom. Med. Col.
Nelden, Andrew L		May 18, '87	New York Hom. Med. Col.
O'Sullivan, Patrick W		Mar. 8, '87	Univ. of the City of N. Y.
Pyle, William L		May 2, '87	University of Pennsylvania.
Paddock, Nathan J		Mar. 12, '79	University of New York.
Radue, William F		July 16, '87	University of New York.
Schierholz, E. C. F. G. E.		Mar 9, '82	University of New York.
Strong, George W		Mar. 1, '82	Eclectic Medical, New York.

HUDSON COUNTY—Continued.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCATION.
Snyder, Charles F.		May 18, '87	Hom. Med. Col., New York.
Schindeler, Theodore		Apr. 30, '70	Univ. Griefswold, Germany.
Thomas, Julian P.		Mar. 1, '87	Med. University of Georgia.
Whalley, Thomas		Apr. 30, '55	Royal Col. of Surg., Eng
Giegenhorn, Otto		July 4, '86	Univ. of Berne, Switzerland.

HUNTERDON COUNTY.

Apgar, Francis Asbury	New Germantown.	Mar. 1, '76	Col. of Med., Bellevue Hosp.
Garvin, William D.	Clinton	Apr. 30, '85	Hahneman Med. Col., Phila.
Seip, George W.	Reading, Pa.	Mar. 8, '62	Jefferson Med. Col., Phila.

MERCER COUNTY.

Woods, Robert A.			Tennessee Univ., Nashville.
Bunn, Lucilla L.			Phila. Ins. Electropathical.
Hollingshead, Emily F.			Hom. Hospital College, Cleveland, Ohio.
Kelly, Edward			Baltimore University, Balt.
Brown, Carolus C.			Curators' Col. Medica, Phila.
Latta, Sam'l Whitehill			Pennsylvania Univ., Phila.
Adams, Charles Franklin.			Jefferson Med. Col., Phila.
Worthington, Henry R.			Media College, Phila., Pa.
Burchell, John Gale			Eclectic Med. College, Pa.
King, Joseph H.			Eclectic College, Phila., Pa.
Baily, Edgar C.			Pennsylvania Univ., Phila.

MIDDLESEX COUNTY.

Cronin, Joseph J.	South Amboy	Apr. 2, '85	Jefferson Med. Col., Phila.
Lippincott, Franklin B.	New Brunswick	Mar. 10, '64	Jefferson Medical College.
Shotwell, William S.		Mar. 6, '85	Univ. of the City of N. Y.
Woods, Robert A.		Feb. 23, '82	University of Tennessee.
Whitford, Myron J.		Mar. 2, '83	Ill. Col. of Med. and Surg.

MONMOUTH COUNTY.

Burton, Asher S.		Feb. 25, '87	Philadelphia Dental College.
Baruch, Simon		Mar. 5, '62	University of Virginia.
Baker, George H.		Mar. 3, '86	Medical Col., Albany, N. Y.
Bennett, John W.		Apr. 6, '87	Medical College, Phila.
Cary, Cora E.		Feb. 23, '82	Hahneman Medical College.
Cary, George W.			Affidavit of 20 years' practice.
Chattle, Thomas H		July 15, '86	Vermont University.
Clarkson, Frederick V.		Mar. 2, '76	Col. Phys. and Surg., N. Y.
Dixon, George A.		Mar. 1, '78	Columbia Med. Col., N. Y.
Fuller, Philip H.	Eatontown	July 3, '85	Vermont University.
Griswold, William		Apr. 15, '86	Hom. Med. Col., N. Y.
Swift, Edwin E.		Mar. 13, '80	University of New York.
Scott, George		Mar. 1, '71	Bellevue Medical College.
Worthington, David J.		Mar 10 '66	Jefferson Med. Col., Phila.

MORRIS COUNTY.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCATION.
Finn, Patrick McC.			Agri University of Vermont.
Flagg, J. W.		Nov. —, '80	Columbia College, New York.
Miller John	German Valley	Mar. 6, '86	University of New York.
McFarlane, Andrew H.		Mar. 10, '87	Albany Medical College of Union University.
O'Reilly, John H.		Mar. 14, '87	Bellevue Hos. Med. Col., N.Y.
Woodruff, Frank C.			New York Col. Med. Hosp.

OCEAN COUNTY.

Budlong, O. W.	Lakewood	Mar. —, '80	Collegii Georgiopolitani.
Griswold, William	Lakewood	Apr. 15, '86	Novum Ebor. Hom. Med. Col.
Stone, William C.		Mar. 1, '80	Bellevue Hospital Med. Col.
Wood, Robert A.		Feb. 23, '82	Nashville Medical College.

PASSAIC COUNTY.

Alderton, Henry A.		Sept. —, '84	Col. of Phys. and Surg., N.Y.
Agnew, Francis E.	Paterson	May 12, '85	Col. of Phys. and Surg., N. Y.
Atkinson, James W.	Paterson	June 2, '86	Long Island Hosp. College.
Born, Reuben Hill			Bellevue Hosp. Med. Col.
Crooks, James, Jr.	Paterson	May 18, '87	New York Hom. Med. Col.
De Baun, Edwin	Passaic	Apr. 16, '85	New York Hom. Med Col.
Doty, Edward W.	Paterson	June 2, '86	Long Island Hosp. Med. Col.
De Uling, Ernestus B.	Paterson	Sept 10, '62	University of Vienna.
Hopper, C. Percy	Paterson	Mar. 15, '83	Homœopathic Col. of N. Y.
Harrison, J. Charles	Newark	Mar. —, '83	Eclectic Med. Col., Chicago.
Jamison, Alcinous	Paterson	Feb. 11, '78	Fort Wayne, Ind., Med. Col.
McEncroe, J. F.	Paterson	May 12, '87	Col. of Phys. and Surg., N. Y.
Phelps, O. Dodge	Paterson	Mar. 6, '83	U. S. Med. College, N. Y.
Palmer, George M.	Paterson	Mar. 14, '80	Eclectic Med. College, N. Y.
Tuller, Malcolm B.	Paterson	May 10, '73	Hahneman Med. Col., Phila.

SALEM COUNTY.

Bradfute, Campe S.	Alloway	Apr. 5, '87	Jefferson Med. College, Phila.
Chavanne, Henry	Salem	Apr. 5, '87	Jefferson Med. College, Phila.
Cornell, Samuel H.	Moorestown		Affidavit of 20 years' practice.

SOMERSET COUNTY.

[No Medical Diplomas filed in 1887.]

SUSSEX COUNTY.

Morrison, Ephraim	Newton	Mar. 1, '75	Col. of Med., Bellevue Hosp.
Straley, Sidney B.	Andover	Mar. 15, '87	Col. of Phys. and Surg., Balt.

UNION COUNTY.

NAME OF PHYSICIAN.	P. O. ADDRESS.	DATE OF DIPLOMA.	INSTITUTION CONFERRING DIPLOMA AND LOCATION.
Bridgeman, Geo. Herbert	Elizabeth	June 29, '81	Medical School of Harvard Univ. of Massachusetts.
Damon, S. James	Elizabeth	Dec. 1, '76	American Health Col., Cin.
Goelch, Augustin H.	Plainfield	——, '74	Bellevue Med. College, N. Y.
Hood, Charles J.			University of Michigan.
Leary, Joanna Gaston	Elizabeth	Apr. 30, '87	New York Medical College and Hosp. for Women.
Woodruff, Maria Louisa	Rahway	Oct. 8, '84	Orange Memorial Hosp., N. J.

WARREN COUNTY.

Albertson, William C.	Belvidere	May 1, '86	University of Pennsylvania.
Albright, John Calvin	Springtown	Mar. 8, '87	Univ. of City of New York.
Morton, Edward K.	Belvidere	——, '84	Col. of Phys. and Surg., N. Y.
Vail, William H.	Blairstown	——, '69	Col. of Phys. and Surg., N. Y.
Beatty, Enos Edward B	Stewartsville		
Cavanaugh, James J., Jr.	Belvidere	——, '84	Bellevue Hos. Med. Col., N. Y.
Eckel, P. Judson	Washington	——, '87	Pa. Col. of Dental Surgery.
Mattison, John V.	Washington	——, '87	Col. of Phys. and Surg., N. Y.

LIST OF PRACTICING PHYSICIANS

IN THE STATE, WITH THEIR LOCALITIES BY COUNTIES AND TOWNSHIPS, AND THEIR P. O. ADDRESS.

In the constant correspondence of this office and the important relations that the medical profession bears to the public health and to the returns of Vital Statistics, it has been found necessary to secure such a registry as enables us to be aware of the localities of medical men. The list is very nearly complete, although it is probable a very few omissions may have occurred. Of any such we will be glad to be informed, or of any errors made. The particular school of practice can be ascertained by reference to the lists of registry in this and former reports. The list does not assert anything as to the individual diplomas, but is such as is furnished from the vicinity. Place of graduation or other particulars are to be found at the offices of the county clerks, as by law every one who, for any time, practices medicine in this State, must *file* a copy of the diploma from a regularly-chartered medical college in the county where the settlement is made, or a certificate of twenty years' practice in one locality.

ATLANTIC COUNTY.

NAME.	P. O. ADDRESS.
TOWN OF ABSECON.	
Edward H. Madden	Absecon.
Talcot P. Waters	"
J. Kay Pitney	"
John R. Flemings	"
ATLANTIC CITY.	
L. H. Armstrong	Atlantic City.
A. W. Baily	" "
Wm. Bennett	" "
Geo. W. Crosby	" "
Rebecca Hallowell	" "
Chester W. Harvey	" "
Phillip Marvel	" "
Mary Miller	" "
John C. Purcell	" "
W. Boardman Reed	" "
Eugene S. Reed	" "
ATLANTIC CITY—*Con'd.*	
Lewis Reed	Atlantic City.
Thos. K. Reed	" "
Edward A. Reiley	" "
John E. Sheppard	" "
Chas. Souder	" "
Lewis R. Souder	" "
M. West	" "
Williard Wright	" "
W. M. Pollard	" "
M. D. Youngman	" "
BUENA VISTA TWP.	
(No physicians reported.)	
EGG HARBOR CITY.	
Theo. H. Boysen	Egg Harbor City.
J. U. Elmer	" " "

ATLANTIC COUNTY—Continued.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
EGG HARBOR TWP.		TOWN OF HAMMONTON.	
J. H. North	Pleasantville.	J. W. Snowden	Hammonton.
G. S. Kirby	"	Edward North	"
R. M. Sooy	"	Wm. McK. North	"
S. C. Edmunds	Linwood.	Jos. H. North, Sr.	"
J. B. Somers	"	Geo. F. Jahucke	"
Dr. Corson	Bargaintown.	Theo. G. Bieling	"
G. De Mills	English Creek.		
S. De Mills	" "	MULLICA TWP.	
GALLOWAY TWP.		H. W. Smith	Elwood.
E. M. Harris	Port Republic.	C. G. Nichols	Green Bank.
HAMILTON TWP.		Edward North	Hammonton.
D. B. Ingersoll	Mays Landing.	WEYMOUTH TWP.	
J. H. James	" "		
S. A. Campbell	" "		
E. C. Hyde	" "	(No physicians reported.)	

BERGEN COUNTY.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
ENGLEWOOD TWP.		ORVIL TWP.	
Daniel A. Currie	Englewood.	Chas. W. Badeau	Allendale.
J. W. Terrey	"	PALISADE TWP.	
John A. Wells	"	J. J. Haring	Tenafly.
Hardey M. Banks	"	Milton Ternure	"
D. A. Baldwin	"	J. M. Simpson	Schraalenburgh.
P. H. Morris	"	RIDGEFIELD TWP.	
Geo. B. Best	"	Alexander Clendinen	Fort Lee.
FRANKLIN TWP.		Joseph Hueger	" "
(No physicians reported.)		Melancthon S. Ayers	Fair View.
HARRINGTON TWP.		William H. O. Taylor	Ridgefield.
Henry A. Crary	Closter.	RIDGEWOOD TWP.	
Lewis B. Parsell	"	J. De Mund	Ridgewood.
Frederick Morris	Norwood.	Wm. Francis	"
HOHOKUS TWP.		SADDLE RIVER TWP.	
Dr. Eliott	Ramseys.	(No physicians reported.)	
Chas. P. De Yoe	"	UNION TWP.	
LODI TWP.		H. H. Hollister	Rutherford.
Oliver Soper	Lodi.	Jeremiah Phelps	"
Dr. Tygert	Carlstadt.	Chas. I. Howard	"
Dr. Mohn	"	A. P. Williams	"
MIDLAND TWP.		WASHINGTON TWP.	
(No physicians reported.)		Henry C. Neer	Park Ridge.
NEW BARBADOES TWP.		Eugene Jehl	" "
Abm. S. Burdett	Hackensack.	Simeon J. Zabriskie	West Wood.
David St. John	"		
Geo. E. Brown	"		
M. E. Russell	"		
Charles F. Adams	"		
Wm. S. Green	"		

BURLINGTON COUNTY.

NAME.	P. O. ADDRESS.
BASS RIVER TWP.	
T. T. Price	Tuckerton.
C. Garrabrant	New Gretna.
BEVERLY TWP.	
A. W. Taylor	Beverly.
Edwin C. Town	"
James V. Roberts	"
J. J. Curry	"
BORDENTOWN TOWN & TWP.	
H. H. Longstreet	Bordentown.
Wm. H. Shipps	"
I. D. Young	"
Lewis Jemison	"
Ryerson Wain	"
I. S Gilbert	"
L. D. Tebo	"
J. G. L. Whitehead	"
E. S. French	Fieldsboro.
CITY OF BURLINGTON.	
Franklin Gauntt	Burlington.
J. Howard Pugh	"
Ledyard Van Renssalaer	"
Edward S. Lansing	"
Walter E. Hall	"
F. Allen Gauntt	"
Joseph Parrish	"
Joseph Shreve	"
E. F. Rink	"
Henry Hollemback	"
CHESTER TWP.	
Samuel C. Thornton	Moorestown.
N. Newlin Stokes	"
J. C. Stroud	"
Frank Stroud	"
Geo. B L. Clay	"
Pusey Wilson	"
Alfred Mattson	"
Joseph Stokes	"
CHESTERFIELD TWP.	
Elias D. Maine	Sykesville.
Charles L Dey	Crosswicks.
John G. L. Whitehead	"
CINNAMINSON TWP.	
Alex. Marcy	Riverton.
Dr. Hammell	Palmyra.
J. A. Vannort	"
H. B Hall	Riverton.
J. D. Janney	Cinnaminson.
DELRAN TWP.	
Alex. Small	Riverside.
Harry Weiler	"
EASTAMPTON TWP. (No physicians reported.)	
EVESHAM TWP.	
P. V. B. Stroud	Marlton.
E. B. Sharp	"
FLORENCE TWP.	
Dr. Baker	Florence.
Dr. Calner	Bustleton.
LITTLE EGG HARBOR TWP.	
Theophilus T. Price	Tuckerton.
S. B. Irwin	"
E Miller	"
C. Garrabrant	New Gretna.
LUMBERTON TWP.	
(No physicians reported.)	
MANSFIELD TWP.	
R. H. Page	Columbus.
D. G Van Mater	"
A. C. Haines	"
A. H. Patterson	Georgetown.
W. L. Woodruff	Columbus.
MEDFORD TWP.	
Lewis L. Sharp	Medford.
Richard S. Braddoch	"
Geo. W. Van Derbrer	"
Josiah Reeve	"
MOUNT LAUREL TWP.	
Tolson B. Franklin	Masonville.
NEW HANOVER TWP.	
Amos Shaw	Jacobstown.
NORTHAMPTON TWP.	
Richard E. Brown	Mount Holly.
Walter Ward	" "
Richard Parson	" "
Charles Bispham	" "
Richard Barrington	" "
Willitt W. Whitehead, Jr.	" "
William H. Melcher	" "
William Chamberlin	" "
Samuel Caley	" "
George F. Ralston	" "
Jacob Griggs	" "
William Parry	" "
PEMBERTON TWP.	
Chas H. Moore	Pemberton.
E. Hollingshead	"
RANDOLPH TWP.	
John C. Carry	Lower Bank.
SHAMONG TWP. (No physicians reported.)	
SOUTHAMPTON TWP.	
Alex. Elwell	Vincentown.
John C. Brown	"
SPRINGFIELD TWP.	
(No physicians reported.)	

BURLINGTON COUNTY—*Continued.*

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
WASHINGTON TWP.		WILLINGBORO TWP.	
Charles G. Nichols	Green Bank.	Franklin T. Haines	Rancocas.
WESTHAMPTON TWP.		William L. Martin	"
(No physicians reported.)		WOODLAND TWP.	
		(No physicians reported.)	

CAMDEN COUNTY.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
CITY OF CAMDEN.		CITY OF CAMDEN—*Con'd.*	
S. Thompson Banes	Camden.	William Warnock	Camden.
Philip W. Beale	"	J. Orlando White	"
D. Benjamin	"	Jesse J. Wills	"
Howard G. Boniwell	"	Joseph H. Wills	"
Robert Casperson	"	James P. Finlaw	"
Henry H. Davis	"	Purnell W. Andrews	"
N. Davis	"	Thomas R. Blackwood	"
William A. Davis	"	Jackson K. Bryant	"
Thos. P. Dickson	"	Samuel Carels	"
A. T. Dobson, Jr.	"	Clark J. Cooper	"
John W. Donges	"	George R. Fortiner	"
John G. Doran.	"	Ida F. Fortiner	"
Wilfred Du Pont	"	Niven Fryer	"
Samuel Ginner	"	A. E. Griffith	"
E. L. B. Godfrey	"	Erving M. Howard	"
O. B. Gross	"	Henry F. Hunt	"
Guilford H. Gunter	"	Willis H. Hunt	"
Lewis Hatton	"	John D. Leckner	"
George W. Henry	"	Melbourne F. Middleton	"
Conrad D. Hoell	"	Frederick P. Pfeiffer	"
Aaron Howell	"	Silas H. Quint	"
Isaac Hugg	"	Jennie Rickards	"
William H. Ireland	"	Eli R. Tullis	"
Samuel B. Irwin	"	George D. Woodward	"
William H. Iszard	"		
Wm. S. Jones	"	CENTRE TWP.	
John F. Leavitt	"	(No physicians reported.)	
John B. Longshore	"		
Alexander McAllister	"	DELAWARE TWP.	
Alexander Marcy	"	Elijah B. Woolston	Marlton.
Alexander Mecray	"		
H. F. Palm	"	GLOUCESTER CITY.	
Dillwyn P. Pancoast	"	James A. Wamsley	Gloucester City.
Edward W. Piper	"	John R. Bennett	" "
Wm. R. Powell	"	Edwin Tomlinson	" "
Sophia Presley	"	Duncan W. Blake	" "
Rufus Reed	"	Henry A. M. Smith	" "
R. W. Richie	"	G. W. Du Bois	" "
James M. Ridge	"	Walter Gardiner	" "
George T. Robinson	"	Richard Gardiner	" "
Thomas G. Rowand	"		
Clarence M. Schellinger	"	GLOUCESTER TWP.	
William Shafer	"		
Edwin R. Smiley	"	Henry E. Branin	Blackwood.
Elijah Snitcher	"	Joseph E. Hurff	"
S. M. Snyder	"		
James G. Stanton	"	HADDON TWP.	
J. H. Stanton	"		
Daniel Strock	"	Bowman H. Shivers	Haddonfield.
F. G. Stroud	"	Charles H. Shivers	"
John W. Sutton	"	Theodore S. Williams	"
H. Genet Taylor	"	Frank E. Williams	"
R. Given Taylor	"	William S. Long	"
E. P. Townsend	"	Lawrence N. Glover	"
J. Francis Walsh	"	B. H. Turner	"

CAMDEN COUNTY—Continued.

NAME.	P. O. ADDRESS.
STOCKTON TWP.	
Jerome L. Artz	Cramer Hill.
H. H. Sheek	" "
WINSLOW TWP.	
(No physicians reported.)	
WATERFORD TWP.	
Daniel M. Stout	Berlin.
William Raleigh	"
William Westcot	"
Robert H. Peacock	"

CAPE MAY COUNTY.

NAME.	P. O. ADDRESS.
CAPE MAY CITY.	
H. F. Kennedy	Cape May City.
V. M. D. Marcy	" " "
Jas. Mecray, Jr.	" " "
E. H. Phillips	" " "
DENNIS TWP.	
Eugene Way	Dennisville.
George G. Carll	South Dennis.
P. M. Way	South Seaville.
LOWER TWP.	
Eli B. Wales	Cold Spring.
MIDDLE TWP.	
John Wiley	Cape May Court House.
Jonathan Leaming	Cape May Court House.
MIDDLE TWP.—*Con'd.*	
Isaac M. Downs	Cape May Court House.
Julius Way	Cape May Court House.
James M. Slaughter	Rio Grande.
Humphry Swain	Goshen.
John H. Hand	Cape May Court House.
OCEAN CITY.	
J. S. Waggoner	Ocean City.
UPPER TWP.	
Joseph C. Marshall	Tuckahoe.
Benj T. Abbott	"
Randolph Marshall	"

CUMBERLAND COUNTY.

NAME.	P. O. ADDRESS.
CITY OF BRIDGETON.	
J. B. Potter	Bridgeton.
T. J. Smith	"
Jos. Sheppard	"
Matt. K. Elmer	"
H. W Elmer	"
Jno. H. Moore	"
Jacob G. Streets	"
David R Streets	"
T. G. Davis	"
Geo H. Harris	"
Dr. Huested	"
COMMERCIAL TWP.	
Stetson L. Bacon	Port Norris.
H. C. Fithian	" "
Dr. Bewley	" "
George E. Butcher	Mauricetown.
Samuel Butcher	"
DEERFIELD TWP.	
Charles C. Phillips	Deerfield Street.
DOWNE TWP.	
Andrew P. Glandon	Newport.
Chas. T. Hill	Dividing Creek.
A. H. Judson	" "
FAIRFIELD TWP.	
J. C. Applegate	Fairton.
GREENWICH TWP.	
Ephraim Holmes	Greenwich.
Thomas E. Slathams	"
HOPEWELL TWP.	
Charles Dare	Shiloh.
Geo. M. Paullen	"
Geo. Tomlinson	"
Dr. Tomlinson	Roadstown.
John H. Sweeney	Shiloh.
LANDIS TWP.	
Chas. R. Wiley	Vineland.
Franklin Lane	"
Edw. H. Bidwell	"
E. R. Fuller	"
Judson L. Becha	"
Theo. Foote	"
O. H. Adams	"
Wm. A. English	"
Richard Dixie	"
Louis Cooper	"
Henry Esten	Newfield.
A. C. Taylor	Vineland.
Chas. Brewer	"

CUMBERLAND COUNTY—Continued.

NAME.	P. O. ADDRESS.
LAWRENCE TWP.	
Ephraim Bateman	Cedarville.
Walter F. Glanden	"
Enos T Blackwell	"
Eleazar Farr	"
MAURICE RIVER TWP.	
J. Howard Willets	Port Elizabeth.
Stacy Wilson	" "
CITY OF MILLVILLE.	
W. H. C. Smith	Millville.
J S Whitaker	"
Wm. L. Newell	"
J. W. Wade	"
T. C. Wheaton	"
J C. Wheaton	"
C. H Hubbard	"
STOE CREEK TWP.	
Joseph Tomlinson	Roadstown.

ESSEX COUNTY.

NAME.	P. O. ADDRESS.
BELLEVILLE TWP.	
A. M. Clark	Belleville.
D. M. Skinner	"
BLOOMFIELD TWP.	
Wm. H. White	Bloomfield.
Ed. M. Ward	"
Chas. H. Bailey	"
Wm. H. Van Gieson	"
John E Wilson	"
J. Edward Stubbert	"
Cornelius S. Simpson	"
CALDWELL TWP.	
H. B. Whitehorne	Verona.
H. D. Winans	"
E. E. Peck	Caldwell.
E. R. Laine	"
CLINTON TWP.	
M. Osborne Christian	Irvington.
David S Smith	"
Joseph Wade	"
Joseph Ward	Waverly.
EAST ORANGE TWP.	
T. R. Chambers	East Orange.
W. B. Graves	" "
J. H. Duffield	" "
W. D. Robinson	" "
W. K. Gray	" "
G. C. Blakelock	" "
Ralph Blakelock	" "
W. K. Davis	" "
S. L. Eaton	" "
Wilton D. Garrett	" "
Elizabeth J. T. Gould	" "
Richardson Gray	" "
Thomas N. Gray	" "
Mary D Hussey	" "
Anna H. Johnson	" "
W. G. Mitchell	" "
Eliza B. Phelps	" "
A. H. Van Riper	" "
A. Walton	" "
Dr. Groves	" "
FRANKLIN TWP.	
Seffrine Daily	Franklin.
LIVINGSTON TWP. (No physicians reported.)	
MILLBURN TWP.	
Wellington Campbell, Jr	Short Hills.
David E. English	Millburn.
MONTCLAIR TWP.	
J. J. H. Love	Montclair.
J. W. Pinkham	"
Wm. B. Berry	"
C. W. Butler	"
C. H. Shelton	"
James S. Brown	"
CITY OF NEWARK.	
H. J Anderson	Newark.
W. J. Andrews	"
John S. Adams	"
Joseph S Ayres	"
W R. Bruyere	"
E D. L. Bradin	"
J D. Brumley	"
W S. Baker	"
A. K. Baldwin	"
H C Bleyle	"
R L. Burrage	"
Chas. D. Bennett	"
T H. Baldwin	"
Rudolph Braum	"
E W. Burris	"
Milton Baldwin	"
James B. Burnett	"
Henry L Coit	"
J. Henry Clark	"
Joseph A Corwin	"
T. W. Corwin	"
H. B. Crane	"
M. S. Crane	"
A. Coles	"
W. E Carroll	"
Wm. S. Disbrow	"
Chas J. Duffy	"
Laban Dennis	"
D. M. Dill	"
A. C Dougherty	"
R G P. Deiffenbach	"
F. M. Day	"
Anna F. Dressler	"
Daniel Elliott	"
James Elliott	"

ESSEX COUNTY—Continued.

NAME.	P. O. ADDRESS.
CITY OF NEWARK—*Con'd.*	
Edward Everett	Newark.
D. J. Edwards	"
Emma W. Edwards	"
Frederick Freiss	"
Joseph Fewsmith, Jr	"
Samuel H. Frazer	"
H. Frankendorff	"
Wm. Glatzmeyer	"
Frank Gruber	"
Robert Gillin	"
H. W. Gedicke	"
Emil Guenther	"
R. S. Gage	"
Susanna Gastner	"
C. W. Hagan	"
John F Hager	"
Joseph H. Hayden	"
Edgar Holden	"
L C. Hollister	"
Ella Haines	"
Edwin J. Howe	"
Jacob Hester	"
P. V. P. Hewitt	"
Joseph Hedges	"
Herman C. H. Herold	"
W. E. Hitchcock	"
H. C. Hendry	"
Bruno Hood	"
E. P. Illiff	"
Edward Ill	"
S. Wasson Jones	"
W. M. Johnson	"
J. C. Johnson	"
George R. Kent	"
Henry A. Kornemann	"
Harriet L. Knudsen	"
Thomas N. Loweree, Jr	"
W. F. Lauterborn	"
Frank Lehmacker	"
Chas. F. J. Lehlbach	"
Ernst M Lyon	"
Wm. H C. Lee	"
George Meeker	"
F. B. Mandeville	"
Wm. H. Martland	"
John R. McDermott	"
Henry Mahr	"
Archibald Mercer	"
M. A. Mills	"
D. D. Mulcahey	"
John R Mulholdana	"
F. L. Meyer	"
Sarah R. Mead	"
E. D. Neuman	"
V. Nager	"
E. A Osborne	"
J. D Osborne	"
Chas. H. Osborne	"
George O'Gorman	"
W. N. Pindel	"
J. W Read	"
John M. Rand	"
Philip Ricord	"
M. N Robinson	"
H. P. Roden	"
Morton Robinson	"
Wm. R. Robinson	"
Wm. J Rankin, Jr	"
P. Roth, Jr	"
S. E. Robertson	"
C. E. Severance	"
R. G. Stanwood	"
Wm A. Smith	"
CITY OF NEWARK—*Con'd.*	
Lott Southard	Newark.
Wm Schelling	"
C. A. Schureman	"
D W. Smith	"
Chas W. Stickney	"
Fayette Smith	"
Smith & Lyon	"
R M. Sutphen	"
Fred. H. Stevens	"
Edward Sealey	"
Joseph S. Sutphen	"
Ernest Schoeffler	"
D. D. Sweeny	"
Theron G. Sutphen	"
B. H. B. Sleght	"
Nicholas Turtle	"
S. W. Taylor	"
Simon P. Taft	"
Wm. Titus	"
H. H. Tichenor	"
Chas. F. Underwood	"
Geo. A. Van Wagenen	"
Carl Vogler	"
S W. Van Duyne	"
Ira C. Whitehead	"
James H Ward	"
Geo S Ward	"
Leslie D Ward	"
Wm. S Ward	"
C. S. Whitehead	"
James E. Wrightson	"
D. L. Wallace	"
Arthur Ward	"
Geo. N. Wait	"
Aaron C. Ward	"
Joseph C. J. Young	"
Chas Young	"
Chas. M. Zeh	"
CITY OF ORANGE.	
Frank E. Baker	Orange.
George Bayles	"
J. H. Bradshaw	"
Carl Buttner	"
C. M Conant	"
Thos G Fitch	"
H. P. Gerbert	"
F A. Gile	"
Thos. W. Harvey	"
Wm. H. Holmes	"
Henry Marion	"
S. F. Phelan	"
Wm. Pierson	"
Geo W. Richards	"
J. L. Seward	"
J Y. Simpson	"
Sarah C Spottiswoode	"
Jos. W. Stickler	"
Frank J. Tetreault	"
Wm. P. Vail	"
Stephen Wickes	"
SOUTH ORANGE TWP.	
A. A. Ransom	South Orange.
William J. Chandler	" "
W. Heberton	" "
Milfred Runyon	" "
Mahlon H C. Vail	Vailsburg.
Lucy S. Forbes	South Orange.
Phœbe D. Brown	Wilton.
WEST ORANGE TWP.	
B. L. Dodd	Orange.

GLOUCESTER COUNTY.

NAME.	P. O. ADDRESS.
CLAYTON TWP.	
Samuel S. Fisher	Clayton.
Albert Powel	"
H. G. Buckingham	"
Charles Duffelle	"
DEPTFORD TWP.	
(No physicians reported.)	
EAST GREENWICH TWP.	
(No physicians reported.)	
FRANKLIN TWP.	
A. A. Smith	Malaga.
GLASSBORO TWP.	
John Down Heritage	Glassboro.
Thomas Lee	"
Jacob Iszard	"
Meredeth J. Luffbary	"
Seymore Wescoat	"
Howard Iszard	"
GREENWICH TWP.	
E. L. Reeves	Paulsboro.
R. H. Reeves	"
Geo. C. Laws	"
Samuel T. Miller	"
HARRISON TWP.	
E. E. De Groff	Mullica Hill.
John H. Ashcraft	" "
LOGAN TWP.	
Eugene T. Oliphant	Bridgeport.
P. E. Stillwagon	"
MANTUA TWP.	
Albert Trenchard	Mantua.
E. Z. Hillegass	"
Henry D. Carr	Pitman Grove
MONROE TWP.	
J. Gaunt Edwards	Williamstown.
C. M. Halsey	"
SOUTH HARRISON TWP.	
Samuel F. Stanger	Harrisonville.
WASHINGTON TWP.	
Cyrus B. Philips	Hurffville.
WEST DEPTFORD TWP.	
(No physicians reported.)	
CITY OF WOODBURY.	
Henry C. Clark	Woodbury.
D. R. Gardiner	"
C. G. Abbott	"
Geo E. Reading	"
H. A. Wilson	"
Wm. A. Glover	"
Wallace McGeorge	"
H. B. Diverty	"
WOOLWICH TWP.	
B. F. Buzby	Swedesboro.
L. F. Halsey	"
J. F. Mustgrave	"

HUDSON COUNTY.

NAME.	P. O. ADDRESS.
H. H. Abernethy	Jersey City.
B. A. Andrew	" "
Wm. H. Ambercrombie	" "
Hugh T. Adams	" "
Geo. F. Appleton	" "
Ulamor Allen	" "
Henry Allers	Harrison.
Clovis Adams	Jersey City.
C. L. G. Anderson	" "
D. R. Atwell	Hoboken.
Matilda H. Aldridge	Jersey City.
Chas. D. Alton	" "
E. P. Buffett	" "
Horace Bowen	" "
J. B. Burdett	" "
Eleazer Bowen	" "
W. E. Bullard	" "
H. M. Brush	Bergen Point.
H. G. Bidwell	Jersey City.
William Briegleb	" "
R. Belmer	" "
C. A. Brown	Hoboken.
I. B. Bucher	Bayonne.
W. C. Buchly	Jersey City.
Louis Baumann	" "
Otto Bosco	Hoboken.
J. S. Briggs	Jersey City.
W. S. Boyd	" "
P. W. Barber	Arlington.
J. J. Bauman	Jersey City.
F. A. Benedict	" "
R. F. Chabert	Hoboken.
James Craig	Jersey City.
C. H. Case	" "
J. E. Culver	" "
W. J. Cadmus	" "
C. B. Converse	" "
Wm. A. Clark	" "
C. W. Cropper	" "
H. H. Cahill	" "
S. W. Clason	Arlington.
D. W. Culver	Jersey City.
A. Hyatt Clark	Arlington.
S. W. Clark	Jersey City.
F. W. Corwin	Bayonne.
B. P. Craig	Jersey City.
A. J. Carpenter	" "
Edward A. Cudlipp	" "
Joseph J. Craven	" "
Wm. A. Durrie	" "

HUDSON COUNTY—Continued.

NAME.	P. O. ADDRESS.
Ephraim De Groff	Town of Union.
N. R. Derby	Bergen Point.
Sarah E. De Hart	Jersey City.
M. F. De Hart	" "
G. K. Dickinson	" "
W. A. Durrie, Jr.	" "
Alexander Dallas	Bayonne.
E. I. Deraismes	Town of Union.
Wm. L. Darlington	Jersey City.
John S. Drain	" "
T. Dwyer	Hoboken.
John W Doherty	Jersey City.
J. R. Everitt	" "
L. W. Elder	Hoboken.
H M. Eddy	Jersey City.
Edward Eckardt	Town of Union.
J. A. Exton	Arlington.
E. S. Ettinger	Hoboken.
S. R. Forman	Jersey City.
Wm. R. Fisher	Hoboken.
J. F. Finn	Jersey City.
J. T. Field	Bayonne.
Johannes Faber	Jersey City.
N. Foote	" "
Benj. W. Ferguson	" "
H. G. Fish	Newark.
John H. Finnerty	Jersey City.
R. B. Gilman	" "
L. J. Gordon	" "
J. F. Golding	" "
F. D. Gray	" "
L. V. Guerin	" "
Wm. Griswold	" "
R. W. Gelbach	Hoboken.
L. G. Goode	Jersey City.
Mrs. A. S. Grinnell	" "
Josiah Hornblower	" "
J. W. Hunt	" "
T. R. Hornblower	" "
D. S. Hardenberg	" "
John Hickman	Bayonne.
A. V. Hill	Guttenberg.
A. J. Holcombe	Jersey City.
S. A. Helfer	Hoboken.
W. B. Hatch	Jersey City.
Melissa Hinchman	" "
A. C. Hoffman	" "
C. T. Hetzel	Town of Union.
H. W. A. Haase	Jersey City.
Peter Hoffman	" "
J. P. Henry	" "
H. Jay Holcombe	" "
J. O Hoffs	Bayonne.
P. Hommell	Jersey City.
C. P. Hopper	New York City.
Hans Haegelsberger	Bayonne.
Dennis I. Healy	"
James Hoffman	Jersey City.
H. E. Hunt	" "
Fredrick Halves	Hoboken.
A. W. Herzog	"
S. A. Hollister	Jersey City.
C. E. Jaeckel	" "
Wm. F. Jones	" "
John Kudlich	Hoboken.
Adolph Kirsten	Jersey City.
John Keating	" "
Wm. T. Keeler	Harrison.
Geo. W. King	Snake Hill.
Wm. T. Kudlich	Hoboken.
C. F. Kyte	Jersey City.
T. Harris Kirk	Hoboken.
O. E. Kopetschny, Sr.	Jersey City.
E. F. Kopetschny	" "
Gertrude B. Kelly	Hoboken.
A. C. Kammerer	"
O. E. Kopetschny, Jr	Jersey City.
A. A. Lutkins	" "
Mortimer Lampson	" "
John Lochner	" "
Wm. Henry Lewis	Bergen Point.
C. C. Lathrop	Jersey City Hosp.
W. C. Lutkins	" "
H. H. Lynch	" "
E H. Linnell	Hoboken.
Albert Lignot	Jersey City.
Thomas Lynch	Hoboken.
H. L. Lockwood	Jersey City.
C. A. Limeburner	" "
H. A. Long	" "
F. H. Lutze	Hoboken.
A. J. Loomis	Jersey City.
J. T. Luck	Town of Union.
W. B. La Bau	Hoboken.
E. P. Luce	Bayonne.
T. F. Morris	Jersey City.
L. A. McBride	" "
J. H. McDowell	" "
J. D. McGill	" "
Daniel Murray	" "
T. J. McLaughlin	" "
John Mohns	Town of Union.
C. H. McNeil	Jersey City.
Louis Michel	West Hoboken.
S. V. Morris	Jersey City.
D. M. MacMartin	" " Hosp.
George McNaughton	" "
S. I. Myers	Bayonne.
B. R. Morrow	Jersey City.
David McClellan	West Hoboken.
Edward Rothe	Jersey City Hosp.
V. C. B. Means	" " "
W. J. McDowell	" "
W. V. McKenzie	" "
A. T. Muzzy	" "
J. W. MacMillan	" "
A. C. Muttart	" "
Geo. F. Meeker	Newark.
W. H. Newell	Jersey City.
F. E. Noble	" "
Frank Nichols	Hoboken.
J. L. Nevin	Jersey City.
H. L. Norris	West Hoboken.
R. G. Nolan	Bergen Point.
John J. Nevin	Jersey City.
H. F. Nichols	Hoboken.
Jennie W. Newell	Jersey City.
Andrew L. Nelden	" "
T. C. O'Callaghan	" "
F. Straughn	" "
L. A. Opdyke	" "
John F. O'Grady	" "
Patrick O'Sullivan	" "
E. W. Pyle	" "
J. A. Petrie	" "
R. M. Petrie	" "
J. J Pendergast	" "
John Pindar	Hoboken.
James Paul	Jersey City.
F. W. Pettigrew	" "
F. G. Payn	Bayonne.
R. W. Peacock	Jersey City.
J. H. Platt	Bayonne.
Geo. F. Pitts	Hoboken.
Gotthold Pape	"
Edw. E. Peek	Jersey City Hosp.
Wm. J. Parker	" "
Henry Peffer	" "

HUDSON COUNTY—Continued.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
C E. Putnam	Jersey City.	G. E. Steel	Jersey City.
Wm. L. Pyle	" "	Erwin Schierholz	" "
John Pringle	Harrison Township	C. F. Snyder	" "
N. J. Paddock	Jersey City.	John J. Sutton.	Bayonne.
I. N. Quimby	" "	George M. Silvers	Jersey City.
D. L. Reeve	" "	Theodore Schindeler	Hoboken.
Walter Rae	" "	George N. Tibbles	Jersey City.
P. Rector	" "	George E Titus	" " Hosp.
C. G H. Rothe	" "	Paul J. Taylor	Hoboken.
H. E. Rothe	Harrison.	Hans Treskow	New York City.
H. B. Rue	Hoboken.	William H O. Taylor	Town of Union.
Edward Rothe	Jersey City Hosp.	Gustavus F. Theel	
M. C. Redmond	" "	Julian P Thomas	Jersey City.
J. H. Rosenkrans	Hoboken.	A. F. Van Horn	" "
J. W. Reid	Harrison.	J H. Vondy	" "
W. H. Russell	Jersey City.	John D. Van Saun	" "
Thomas C. Rhoads	Weehawken.	John Vanderback	Guttenberg.
Edward C. Rushmore	Jersey City Hosp.	P. Vast	Newark.
W. F. Radue.	" "	John Van Vorst, Jr	Jersey City.
S. V. W. Stout	" "	W. W. Varick	" "
M. F. Squire	Harrison.	J J. Van Horne	" "
G. D. Saltonstall	Hoboken.	Hamilton Vreeland	" "
F C. Selnow.	Jersey City.	J. L. Vandeventer	" "
Noah Sanborn	Bayonne.	B. A Watson	" "
H R. Simmons	Jersey City.	Theodore F. Wolfe	" "
P. M. Senderling	" "	James Wilkinson	" "
Frederick Straughn	" "	F. H. Whittemore	" " Hosp.
H M. Smith.	" "	W. P Watson	" "
Joseph E. Salter	Bayonne.	George Wilkinson	" "
H. De L. Sherwood	Jersey City.	W. P. Ware	" "
C. A G. Schuhl	" "	Conrad Wienges	" "
Hugo Senftleben	Hoboken.	John Williams	Arlington.
F. C. Smith	Guttenberg.	Joseph Wolfson	Jersey City.
F. (or J.) Schmidt	Hoboken.	A. W. Warden	Town of Union.
C. I. Simon	"	James E. Weeks	Jersey City.
Frederick Spring	Bergen Point.	C. F. Wolff	Town of Union.
Richard Schlemm	Town of Union.	Mary A. Willis	Jersey City.
E. T. Steadman	Hoboken.	W. S. Wilson	" "
J. L. Sanborn	Jersey City.	H. S. Warwick	" "
H. W. Searing	Arlington.	Thompson Whalley	" "
J. A. Stegmair	Jersey City.	Arthur Ward	Newark.

HUNTERDON COUNTY.

NAME.	P. O. ADDRESS.
ALEXANDRIA TWP.	
Moses D. Knight	Little York.
Henry Race	Pittstown.
BETHLEMEM TWP.	
Thomas E. Hunt	Glen Gardner.
Edgar Hunt	" "
Wm. R Little	Bloomsbury.
J. M. Linaberry	Bloomsbury and Somerville.
A. C. Smith.	Bloomsbury.
Howard Servis	Junction.
Robert Fenwick	"
CLINTON TWP.	
W. E Berkaw	Annandale.
David P Jackson	Lebanon.
John F. Grandin	Hamden.
S. Vansickel	Clinton.
Wm. Knight	"
W. C. Warrington	"
A. Jacobus	"
DELAWARE TWP.	
Isaac S. Cramer	Sergeantsville.
Geo. V. Best.	Rosemont.
O. H. Sproul	Stockton.
EAST AMWELL TWP.	
C W. Larison	Ringoes.
John V. Robbins	"
John Sylvaria	"
Amos M. Hart	"
P. C. Young	"
FRANKLIN TWP.	
Q. E Snyder	Quakertown.
BOROUGH OF FRENCHTOWN.	
Asher Reiley	Frenchtown.
E. K. Deemy	"
Wm. F. Finney	"
Wm. C. Williams	"

HUNTERDON COUNTY—Continued.

NAME.	P. O. ADDRESS.
HIGH BRIDGE TWP.	
W. C. Alpaugh	High Bridge.
William Hackett	" "
HOLLAND TWP.	
Geo. T. Ribble	Milford.
J. N. Lowe	"
KINGWOOD TWP.	
E. D. Leidy	Baptisttown.
CITY OF LAMBERTVILLE.	
Wm. Wetherill	Lambertville.
Geo. L. Romine	"
Geo. H. Larison	"
F. W. Larison	"
Peter McGill	"
Edw. W. Closson	"
J. E. Stiles	"
S. Willard Oley	"
A. L. Closson	"
Joseph E. Wells	"
LEBANON TWP.	
Terrance A. H. Heron	Junction.
Thos. H. Carey	Glen Gardner.

NAME.	P. O ADDRESS.
RARITAN TWP.	
Wm. H. Schenck	Flemington.
Asbury Parrish	"
Geo. R. Sullivan	"
A. Shannon	"
T. B. J. Burd	"
Geo. R Rowland	"
John H. Ewing	"
Geo. P. Rex	Reaville.
Eugene Garrison	"
READINGTON TWP.	
J. D. McCauley	Centreville.
Geo. W. Bartow	Three Bridges.
T. A. Skillman	Stanton.
W. W. Purcell	White House Station.
John V. Johnson	White House.
Thomas Johnson	Readington.
Wm. D. Quimby	"
TEWKSBURY TWP.	
H. H. Miller	Mountainville.
Francis A. Apgar	New Germantown.
T. Miller	Califon.
UNION TWP.	
N. B. Boileau	Jutland.
WEST AMWELL TWP.	
(No physicians reported.)	

MERCER COUNTY.

NAME.	P. O. ADDRESS.
CHAMBERSBURG BOROUGH.	
Elmer Barwis	Chambersburg.
R. C. Hutchinson	"
H. B. Costill	"
W. H. G Griffith	"
C. F. Adams	"
W. McD. Struble	"
J. T. Johnston	"
E. W. Johnson	"
H. B. Witte	"
A. Coleman	"
EAST WINDSOR TWP.	
Lloyd Wilbur	Hightstown.
Geo. E. Titus	"
J. P. Johnson	"
EWING TWP.	
John W. Ward	Trenton.
John Kirby	"
HAMILTON TWP.	
Geo. R. Robbins	Hamilton Square.
Dr. White	" "
Dr. Mokey	Crosswicks.

NAME.	P. O. ADDRESS.
HOPEWELL TWP.	
E. L. Welling	Pennington.
I. Hart	"
Edgar Hart	"
O. G. Sands	Titusville.
E. P. Hawke	Hopewell.
J. A. Miller	"
LAWRENCE TWP.	
Edmund De Witt	Lawrenceville.
MILLHAM TWP.	
Walker G. Macdonald	Millham.
PRINCETON TWP.	
W. J. Lytle	Princeton.
A. K. Macdonald	"
J. H. Wikoff	"
E. H. Bergen	"
O. H. Bartine	"
J. G. Bayles	"
CITY OF TRENTON.	
John Woolverton	Trenton.
Wm. W. L. Phillips	"
Richard R. Rogers	"

MERCER COUNTY—Continued.

NAME.	P. O. ADDRESS.
CITY OF TRENTON—*Con'd.*	
Richard R. Rogers, Jr.	Trenton.
Cornelius Shepherd	"
David Warman	"
Lyman Leavitt	"
Joseph L. Bodine	"
Wm. W. Wyckoff	"
H. Waldburg Coleman	"
William Green	"
J. I. B. Ribble	"
William Elmer	"
Thos. H. Mackenzie	"
William S. Lalor	"
Chas. H. Dunham	"
William Rice	"
Wm. A. Clark	"
Wm. B. Van Duyn	"
Robt. C. Hutchinson	"
Henry M. Weeks	"
Alex. M. Steen	"
Chas. B. Leavitt	"
Chas. H. McIlwaine	"
Horace G. Wetherill	"
Wm. McD. Struble	"
Elmer H. Rogers	"
Joseph B. Shaw	"
Addison H. Dey	"
Frank V. Cantwell	"
Margaret H. Preston	"
Frank H. Williams	"
Jos. C. Boardman	"
Isaac Cooper	"
A. H. Worthington	"

NAME.	P. O. ADDRESS.
CITY OF TRENTON—*Con'd.*	
Wm. G. McCullough	Trenton.
Chas. W. Gerry	"
Nelson D. Oliphant	"
John M. Maul	"
Edward Kelly	"
C. F. Adams	"
H. M. Beatty	"
C. C. Brown	"
L. L. Bunn	"
A. Coleman	"
J. W. Cooper	"
H. B. Costill	"
W. H. G. Griffith	"
E. E. Hollinshead	"
M. Jenkins	"
E. W. Johnson	"
F. Johnson	"
W. McDonald	"
H. Read	"
W. T. Rogers	"
J. H. Satterthwaite	"
J. W. Stevenson	"
J. P. Turner	"
J. D. Tantum	"
E. Witte	"
J. K. Young	"
WASHINGTON TWP.	
Geo. H. Franklin	Windsor.
WEST WINDSOR TWP.	
(No physicians reported.)	

MIDDLESEX COUNTY.

NAME.	P. O. ADDRESS.
CRANBURY TWP.	
J. C. Holmes	Cranbury.
H. C. Symmes	"
MADISON TWP.	
(No physicians reported.)	
MONROE TWP.	
J. L. Snydam	Jamesburg.
H. D. Zandt	"
CITY OF NEW BRUNSWICK.	
Henry R. Baldwin	New Brunswick.
E. H. Barber	" "
Staats V. D. Clark	" "
David C. English	" "
John Helm	" "
George J. Janeway	" "
Samuel Long	" "
J. Warren Rice	" "
Patrick A. Shannon	" "
John S. Van Marter	" "
Chas. U. Voorhees	" "
Nicholas Williamson	" "
Edward B. Young	" "
G. T. Applegate	" "

NAME.	P. O. ADDRESS.
NEW BRUNSWICK—*Con'd.*	
C. M. Slack	New Brunswick.
A. V. N. Baldwin	" "
Fernando Riva	" "
Adelia Barber	" "
Irenæus S. Davis	" "
David Davis	" "
Franklin B. Lippincott	" "
NORTH BRUNSWICK TWP.	
I. P. Davis	Milltown.
CITY OF PERTH AMBOY.	
John G. Wilson	Perth Amboy.
Edward B. P. Kelly	" "
Howard W. Phillips	" "
Louis S. Blackwell	" "
William W. Hubbard	" "
E. Arthur Hults	" "
PISCATAWAY TWP.	
William J. Nelson	New Market.
D. P. Vail	" "
M. J. Whitford	" "
Peter W. Brakley	Dunellen.
W. E. Shotwell	"

MIDDLESEX COUNTY—Continued.

NAME.	P. O. ADDRESS.
SOUTH AMBOY TWP.	
Ambrose Treganowen	South Amboy.
Smith H Lewis	" "
Alonzo Freeman	" "
L. O. Morgan	" "
August E. Zeitter	" "
SOUTH BRUNSWICK TWP.	
Edgar Carroll	Dayton.

NAME.	P. O. ADDRESS.
RARITAN TWP.	
Charles H. Andrus	Metuchen.
Alonzo C. Hunt	"
Frank B. Norton	"
WOODBRIDGE TWP.	
S. E. Freeman	Woodbridge.
S. P. Harned	"
D. E. Decker	"

MONMOUTH COUNTY.

NAME.	P. O. ADDRESS.
ATLANTIC TWP.	
James E. Cooper	Colts Neck.
EATONTOWN TWP.	
W. S. Kimball	Eatontown.
W. B. Beach	"
G. F. Baker	"
E. M. Beach	West Long Branch.
E. W. Crater	Ocean Port.
FREEHOLD TWP. & VILLAGE.	
D. M. L Forman	Freehold.
I. S Long	"
O. R. Freeman	"
Harry Neafie	"
Wm. W. Burnett	"
Wm. M. Hepburn	"
HOLMDEL TWP.	
Henry G. Cooke	Holmdel.
HOWELL TWP.	
Stephen M. Disbrow	Farmingdale.
Stephen A. Disbrow	"
Van M. Disbrow	"
C. B. Weeks	Turkey.
William R. Kinmouth	Farmingdale.
MANALAPAN TWP.	
A. T. Applegate	Englishtown.
Geo. Hutchinson	"
MARLBORO TWP.	
J. D. Ely	Marlboro.
MATAWAN TWP.	
Cyrus Knecht	Matawan.
A. J. Jackson	"
Philip H. Fuller	"
MIDDLETOWN TWP.	
Edward F. Taylor	Middletown.
Wm. F. Patterson	Chapel Hill.
Daniel D. Hendrickson	Middletown.
John H. Van Mater	Atlantic Highlands

NAME.	P. O. ADDRESS.
MIDDLETOWN TWP.—*Con'd.*	
Russell G. Andrews	Atlantic Highlands
G. W. Labaw	Riceville.
George D. Fay	Highlands.
MILLSTONE TWP.	
W. V. McKenzie	Perrineville.
NEPTUNE TWP.	
G. F. Wilbur	Asbury Park.
C. Pemberton	" "
R. A. Tusting	" "
J. D. Osborne	Newark.
T. Knox Morton	Asbury Park.
Wm. H. Ross	New York City.
Henry Mitchell	Asbury Park.
Bruce Skeator	" "
Wm. Griswold	" "
J. A. W. Hetrick	" "
Samuel Johnson	Ocean Grove.
H. S. Des Anges	Asbury Park.
F. G. Pomeroy	Ocean Grove.
J. N Bugle	" "
D. M. Barr	" "
H. S. Kinmouth	Asbury Park.
J. B. Hunt	" "
Samuel Evans	" "
OCEAN TWP. AND LONG BRANCH.	
T. G. Chattle	Long Branch.
J. B. Goodnough	" "
J. O. Green	" "
H. Heighes	" "
H. H. Pemberton	" "
Geo. W. Brown, Jr.	" "
Joseph A. Taylor	" "
John Bennett	" "
Dr Beach	West Long Branch.
A. H. Smith	New York.
R. L. Kimball	" "
E. H. Keyes	" "
R. McKenzie	" "
Joseph Offenbode	" "
T. R. Coe	" "
RARITAN TWP.	
J. E. Arrowsmith	Keyport.
W. E. Johnson	"
G. T. Welch	"
D. E. Roberts	"
E. B. Reed	"

MONMOUTH COUNTY—Continued.

NAME.	P. O. ADDRESS.
RARITAN TWP.—*Con'd.*	
W. W. Palmer	Keansburg.
W. A. Bevin	Keyport.
SHREWSBURY TWP.	
A. A. Armstrong	Fair Haven.
W. A. Betts	Red Bank.
F. A. Chadwick	" "
J. K. Cheeseman	" "
Thomas A. Curtis	" "
Edward Field	" "
Geo. F. Marsden	" "
James H. Patterson	Shrewsbury.
T. Ridgeway	Red Bank.
J. E. Sayre	" "
Dr. Shafto	Hamilton.
A. F. Trafford	Red Bank.
W. B. Warner	" "
James E. Conover	" "
UPPER FREEHOLD.	
H. G. Norton	Imlaystown.
A. Alexander Howell	Allentown.
P. B. Pumyea	"
H. P. Johnson	"
George W. Shaffer	Cream Ridge.
Abel T. Breure	Hornerstown.
WALL TWP.	
A. A. Higgins	Manasquan.
J. B. Wainright	"
B. Laird	"
W. W. Trout	Spring Lake.
C. H. Thompson	Ocean Beach.
R. W. Herbert	Manasquan.
J. F. Davison	Glendola.
W. Kinmouth	Ocean Beach.
A. P. Yelington	Manasquan.

MORRIS COUNTY.

NAME.	P. O. ADDRESS.
BOONTON TWP.	
A. E. Carpenter	Boonton.
J. G. Ryerson	"
J. H. O'Reilly	"
Cuthbert Wigg	"
Mrs. H. C. Woodruff	"
CHATHAM TWP.	
William H. Martin	Madison.
Calvin Anderson	"
S. H. Reed	"
J. N. De Hart	"
W. J. Wolfe	Chatham.
George M. Swain	"
CHESTER TWP.	
Levi W. Case	
Alonzo Green	
Smith E. Hedges	
HANOVER TWP.	
E. P. Cooper	Parsippany.
G. A. Becker	Whippany.
JEFFERSON TWP.	
Leonard Bright	Berkshire Valley.
MENDHAM TWP.	
John S. Stiger	Mendham.
Henry Stiger	"
Geo. S. Degroot	"
MONTVILLE TWP. (No physicians reported.)	
MORRIS TWP. & MORRISTOWN	
P. C. Barker	Morristown.
Stephen Pierson	"
James Douglas	"
MORRIS TWP. AND MORRISTOWN—*Con'd.*	
A. A. Lewis	Morristown.
F. W. Owen	"
T. B. Flagler	"
Augustus Becker	"
H. B. Andrews	"
Frank Sanders	"
Joseph R. Hoofman	"
A. Whelacker	"
MOUNT OLIVE TWP.	
J. S. Farrow	Flanders.
Geo. W. Wentworth	"
PASSAIC TWP. (No physicians reported).	
PEQUANNOCK TWP.	
A. A. McWithey	Pompton.
H. B. Day	Butler.
George Silvers	"
C. D. V. Romondt	Pompton Plains.
RANDOLPH TWP.	
Thos. R. Crittenden	Dover.
I. W. Condict	"
Geo. O. Cummins	"
Wm. E. Derry	"
Jos. D. King	"
John Byram	"
R. A. Bennett	"
Mary Ford	"
A. W. Condict	Port Oram.
ROCKAWAY TWP.	
R. C. Lumsden	Rockaway.
J. V. Menagh	"
D. S. Ayers	"
F. W. Flagge	"
J. W. Jackson	"

MORRIS COUNTY—Continued.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
ROXBURY TWP.		WASHINGTON TWP.	
		E. C. Willet	German Valley.
John L. Taylor	Succasunna.	Levi Farrow	Middle Valley.
John Ricker	"	John Miller	Stephensburg.
H. C. Wiggins	"	Peter S. Hann	German Valley.

OCEAN COUNTY.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
BERKELEY TWP.		LACEY TWP.	
(No physicians reported.)			
		C. R. Van Doren	Forked River.
BRICK TWP.		Marcus Kenyon	" "
J. H. Platt	Lakewood.	MANCHESTER TWP.	
O. W. Budlong	"		
H. J. Cute	"	(No physicians reported.)	
G. S. Turris	Burrsville.		
H. A. Bennett	Point Pleasant.	OCEAN TWP.	
D. H. Mount	Bayhead.		
		Edmund Bennett	Barnegat.
DOVER TWP.			
		PLUMSTED TWP.	
Rem. L. Disbrow	Toms River.		
Clarence E Disbrow	" "	Charles E. Woodard	New Egypt.
Irving C. Schureman	" "	John Bruer	" "
John W. Webb	" "	C. La Forge	" "
John O. Harra	Island Heights.	Daniel A. Warren	" "
EAGLESWOOD TWP.		STAFFORD TWP.	
Samuel Ashhurst	Beach Haven.	Phineas K. Hilliard	Mannahawkin.
JACKSON TWP.		UNION TWP.	
Chas. La Forge	New Egypt.	Edmund Bennett	Barnegat.

PASSAIC COUNTY.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
ACQUACKANONK TWP.		CITY OF PATERSON.	
J. Selatinow	Richfield.	Willhelm C. Dittmar	Paterson.
Morgan Wilcox Ayres	Upper Montclair.	David W. McFarland	"
		Edward W. Doty	"
LITTLE FALLS TWP.		William Heckman	"
		David McNair	"
Edward A Keeler	Little Falls.	John R. Merrill	"
Mark Van Winkle	" "	James Crooks	"
Henry W. Turbeck	" "	James K. Atkinson	"
J. M. R. Gedney	" "	Reuben H. Born	"
		Ernestus B. De Uling	"
MANCHESTER TWP.		C. Percy Hopper	"
(No physicians reported.)		Alcinons Jamison	"
		J. F. McEncroe	"
CITY OF PASSAIC.		George M. Palmer	"
		Malcom B. Fuller	"
Richard A. Terhune	Passaic.	John H. Banta	"
Jno. C. Herrick	"	Geo. H. Balleray	"
Cornelius Van Riper	"	James S. Bibby	"
S. E Armstrong	"	Wm. Blundell	"
W. H. Carroll	"	Philander A. Harris	"
Chas. A. Church	"	Geo. W. Terriberry	"
N. C. Ricardo	"	Calvin Terriberry	"
E. De Baum	"	O. V. Garnett	"

PASSAIC COUNTY—Continued.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
CITY OF PATERSON—*Con'd.*		CITY OF PATERSON—*Con'd.*	
J. Hengg'er	Paterson.	James F. Stewart	Paterson.
Walter B Johnson	"	M. W. Gillison	"
Thomas J. Kane	"	Geo F. Newcombe	"
Henry Kip	"	F. J. Hepworth	"
John L. Leal	"	F. Bachman	"
E. S. McClellan	"	S. Cyrus Townsend	"
S. R. Merrill	"	B. J Seward	"
C. F. W. Meyers	"	Frank E. Agnew	"
Elias J. Marsh	"	B C. Magennis	"
Rush Neer	"	Ada Carr	"
Wm. K. Newton	"	A. D. Jousset	"
T. F. O'Grady	"	J. Solatinor	"
Henry Parke	"		
J. P. Paxton	"	POMPTON TWP.	
A. W. Rogers	"		
James W. Smith	"	(No physicians reported.)	
Spencer Van Dalsen	"		
C. S. Van Riper	"	WAYNE TWP.	
Henay Withers	"		
W. S. Hurd	"	J. W. Collins.	Pompton.
Oswald Warner	"	William S. Colfax	"
T. T. Kinne	"		
P. S. Kinne	"	WEST MILFORD TWP.	
Davis P. Borden	"		
John H. Bradsworth	"	W. S. Coursin	Oakridge.
W F. Decker	"	Theodore Coursin	"
Wm. Whitley	"	R. G Mains	West Milford.
F. D. Vreeland	"	S. Utter	" "

SALEM COUNTY.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
ALLOWAY TWP.		PITTSGROVE TWP.	
Warren L. Ewens	Alloway.	A. B. Woodruff	Elmer.
L. M. Wallace	"	C. P. Atkinson	Palatine.
S. B. Camp	"	J. P. Cheesman	Elmer.
		Chas. Robinson	"
ELSINBORO TWP.			
(No physicians reported.)		QUINTON TWP.	
		W. Scott Smith	Quinton.
LOWER ALLOWAYS CREEK TWP.		William Patrick, Jr.	"
Francis B. Harris	Canton	CITY OF SALEM.	
W. Scott Smith	Hancock's Bridge.	Quinton Gibbon	Salem.
		Theophilus Patterson	"
LOWER PENNS NECK TWP.		Edward Sharp	"
		B. A. Waddington	"
W. H. James	Pennsville.	Dr. Jackson	"
		Dr. Beckel	"
MANNINGTON TWP.		Dr. Bilderback	"
(No physicians reported.)		Dr. Sherron	"
		Dr. Wiley	"
OLDMANS TWP.		James Patterson	"
		Henry Chevanne	"
James B Ware	Pedricktown.		
Harry Johnson	"	UPPER PENNS NECK TWP.	
PILESGROVE TWP.		Mayhew Johnson	Penns Grove.
		John H. Groff	" "
L. A. D Allen	Woodstown.	John Summerill	" "
Louis Reed	"	Daniel Garrison	" "
Uriah Gilman	"	David Moore	" "
P. G. Souder	"	M. H. Curry	" "
Charles Newton	Sharpstown.		
Naomi Foster	Woodstown.	UPPER PITTSGROVE TWP.	
Sarah Taylor	"	M. J. Paulding	Daretown.

SOMERSET COUNTY.

NAME.	P. O. ADDRESS.
BEDMINSTER TWP.	
J. B. Beekman	Pluckamin.
Edward Perry	Peapack.
Edwin B. Farrell	"
BERNARDS TWP.	
A. F. Voorhies	Baskingridge.
John Dayton	"
R. Van Dorn	Liberty Corner.
Fr Jones	Baskingridge.
E. M. Steele	Bernardsville,
BRANCHBURG TWP.	
Adonis Nelson	Neshanic Station.
BRIDGEWATER TWP.	
H. G. Wagoner	Somerville.
A. P. Hunt	"
Wm. J. Swinton	"
Wm. B. Mathewson	"
J. F. Williams	"
Arthur Kenney	"
Joseph E. Wright	"
J. P. Hecht	Raritan.
J. F. Berg	North Branch.
J. L. Compton	Bound Brook.
E. E. Conover	Martinville.
Edwin T. Davis	Bound Brook.
C. P. P. Fisher	" "
B. B. Mathews	" "
FRANKLIN TWP.	
Wm. B. Ribble	East Millstone.
Farley Fisher	Middlebush.
G. G. Hoagland	Frahklin Park.
HILLSBOROUGH TWP.	
William H. Merrell	South Branch.
George Van Nest	Millstone.
S. O. B. Taylor	"
J. E. Anderson	Neshanic.
MONTGOMERY TWP.	
Wellington B. Searle	Rocky Hill.
Abram B. Mosher	Griggstown.
Jesse S. B. Ribble	Harlingen.
Peter Skillman	"
Lucius D. Tompkins	"
NORTH PLAINFIELD TWP.	
J. H. Carman	Plainfield.
W. E. Mattison	"
WARREN TWP.	
Peter J. Zeglio	Warrenville.

SUSSEX COUNTY.

NAME.	P. O. ADDRESS.
ANDOVER TWP.	
John Miller	Andover.
John C. Clark	"
BYRAM TWP.	
Charles R. Nelden	Stanhope.
C. H. Davison	"
FRANKFORD TWP.	
Joseph Hedges	Branchville.
J. C. Price	"
E. A. Dalrymple	"
Eugene Shumo	"
GREEN TWP.	
Sidney B. Straley	Andover.
HAMPTON TWP. (No physicians reported.)	
HARDYSTON TWP.	
J. B. Pellet	Hamburgh.
J. P. Couse	"
LAFAYETTE TWP.	
John C. Strader	Lafayette.
John L. Allen	"
MONTAGUE TWP. (No physicians reported.)	
TOWN OF NEWTON.	
Levi D. Miller	Newton.
Ephraim Morrison	"
Theophilus H. Andress	"
W. Henry Lewis	"
T. George Cusack	"
SANDYSTON TWP.	
James N. Miller	Laytons
Martin Cole	Hainesville.
SPARTA TWP.	
William H. Douglas	Ogdensburgh.
STILLWATER TWP.	
Charles V. Moore	Stillwater.
Joseph H. McCaughen	Swartswood.

SUSSEX COUNTY—Continued.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
VERNON TWP.		WANTAGE TWP.	
Carlos Allen	Vernon.	Alex. Williamson	Deckertown.
		H D Van Gaesbeck	"
WALPACK TWP.		John Moore	"
		B W. Ferguson	Beemerville.
Frank Beers	Flathookville.	Edgar Potts	Colesville.

UNION COUNTY.

NAME.	P. O. ADDRESS.	NAME.	P. O. ADDRESS.
CLARK TWP. (No physicians reported.)		CITY OF PLAINFIELD—*Con'd.*	
		George W. Endicott	Plainfield.
CRANFORD TWP.		Chauncey M. Field	"
		J T. Fritts	"
Joseph K. McConnell	Cranford.	John F. Griffen	"
		E. W. Hedges	"
CITY OF ELIZABETH.		O. L. Jenkins	"
		Sarah D Keeney	"
Anna J. Crouthers	Elizabeth.	Monroe B Long	"
Geo. W. Bailey	"	H. H. Lowrie	"
Lewis R. Brown	"	Andrew Manning	"
Job S Crane	"	William H. Murray	"
James S. Green	"	Rebecca P. Page	"
Joseph H. Grier	"	Charles H Penfield	"
E. B. Grier	"	Joseph H Platt	"
Thos. L. Hough	"	John B. Probasco	"
Wm. A. M. Mack	"	Edward Rushmore	"
Thos. N. McLean	"	Randolph Titsworth	"
W. H. Miller	"	Thomas H. Tomlinson	"
J. B. Morton	"		
Victor Mravlag	"	CITY OF RAHWAY.	
Alonzo Pettit	"		
John H. Pickett	"	J. J Daly	Rahway.
J. O. Pinneo	"	D. W. C. Hough	"
David Schleimer	"	H. Page Hough	"
Thos. Terrill	"	Elihu B Silvers	"
Wm. F. Turner	"	E. J. Westfall	"
Robert Wescott	"	W. E. Cladek	"
John Younglove	"	W. W. Selover	"
E. R. O'Reilly	"	Wilber Hodgson	"
A. Q. Donovan	"	F W. Oliver	"
N. L. Wilson	"	Israel Lukins	"
David Miller	"	Charles B. Holmes,	"
T. F. Livengood	"	Lewis Drake	"
James Wheeler	"		
Johanna G Leary	"	SPRINGFIELD TWP.	
Tifft Beckwith	"		
Dr. Pierce	"	N. C. Jobs	Springfield.
FANWOOD TWP.		SUMMIT TWP.	
F. W. Wescott	Fanwood.	W. H. Risk	Summit.
A. Coles	"	W. H Lawrence	"
J. A. Coles	"	John Burling	"
LINDEN TWP.		UNION TWP.	
Henry C. Pierson	Roselle.	J. E. Winans	Lyons Farms.
NEW PROVIDENCE TWP.		WESTFIELD TWP.	
Abram Morrell Cory	New Providence.	Joseph B Harrison	Westfield.
		Frederick A. Kinch	"
CITY OF PLAINFIELD.		Frederick A. Kinch, Jr	"
		Sherman Cooper,	"
		T. V. Smith	"
William C. Boone	Plainfield.	Wm. H. Morse	"
Thomas S. Davis	"	William Call	"

WARREN COUNTY.

NAME.	P. O. ADDRESS.
ALLAMUCHY TWP.	
Wm. L. Linabury	Allamuchy.
TOWN OF BELVIDERE.	
P. F. Brakeley	Belvidere.
W. H. McGee	"
E. M. Bergen	"
Wm. C. Albertson	"
Comegys Paul	"
P. F. Lefferts	"
BLAIRSTOWN TWP.	
John C. Johnson	Blairstown.
Harry O. Carhart	"
Milton N. Armstrong	"
William H. Vail	"
FRANKLIN TWP.	
S. B. Crisman	Broadway.
S. A. Welch	Asbury.
FRELINGHUYSEN TWP.	
F. Rorbach	Johnsonsburgh.
GREENWICH TWP.	
Enos Beatty	Stewartsville.
P. F. Hulshizer	"
HACKETTSTOWN TWP.	
John S. Cook	Hackettstown.
R. L. Cook	"
A. E. Martin	"
A. C. Vansickle	"
Theo. Crane	"
J. W. Dalrymple	"
HARDWICK TWP.	
(No physicians reported.)	
HARMONY TWP.	
James D. Dewitt	Harmony.
Garner H. Cline	"
HOPE TWP.	
A. L. Gibbs	Hope.
INDEPENDENCE TWP.	
S. W. Rowell	Vienna.
KNOWLTON TWP.	
Samuel H. Johnson	Delaware.
Robert Bond	Knowlton.
LOPATCONG TWP.	
(No physicians reported.)	
MANSFIELD TWP.	
Henry M. Cox	Port Murray.
OXFORD TWP.	
Geo. S. Dearborn	Oxford.
L. B. Hoagland	"
G. O. Lumson	"
Bonn. W. Hoagland	"
PAHAQUARRY TWP.	
(No physicians reported.)	
TOWN OF PHILLIPSBURG.	
J. F. Sheppard	Phillipsburg.
J. M. Reese	"
L. C. Osmun	"
R. S. Stewart	"
James Cavanaugh, Jr.	"
Isaac Barber	"
L. D. Bieber	"
Charles Crevling	"
J. H. Griffith	"
H. O. Carhart	"
H. R. West	"
POHATCONG TWP.	
Nathan Case	Reiglesville.
J. S. Albright	Springtown.
WASHINGTON TWP.	
William Hartpence	Washington.
Joseph Cook	"
F. M. Cook	"
W. M. Baird	"
J. McKinistry	"
William Stites	"
H. S. Funk	Port Colden.

REPORT

OF THE

BUREAU OF VITAL STATISTICS

OF THE

STATE OF NEW JERSEY

FOR THE

Statistical Year from July 1st, 1886, to July 1st, 1887,

WITH CLIMATOLOGY, ETC.

DEPARTMENT OF STATE.

TO HON. HENRY C. KELSEY, SECRETARY OF STATE.

By EZRA M. HUNT, M.D., D.Sc.,

Secretary and Medical Superintendent of Vital Statistics.

REPORT ON VITAL STATISTICS

BY THE MEDICAL SUPERINTENDENT OF VITAL STATISTICS.

INTRODUCTION.

The attention of all City Clerks, Township Assessors and Local Boards of Health is especially called to chapter XXXIX. of Laws of 1888, as to vital statistics, approved February 15th, 1888.

While not altering in any essential particulars the former laws, it, restates and codifies them and makes their execution more direct. The Local Boards are charged with the duty of enforcing it. It is a very important duty. It does not strike the member of a Board of Health who has not studied the matter, that these returns are the foundation of the best health administration. Yet all leading sanitary authorities insist that we must keep a credit and debtor account of the people if we would study sanitary conditions. Marriage tells us of the number of families. Births inform us of the material on hand and the ages, since the effects of susceptibility and exposure are much determined by this. Death tells us of the operation of insanitary forces. The Inspector who knows how to study the items has an important guide to his work. We earnestly call upon Local Boards by information, by urgent personal address to any that are neglectful, and, if need be, by summary proceeding to enforce the law. See, also, section 12 (VII.), chapter LXVIII., Laws of 1887.

We note the changes in the present law :

I. The penalty for neglect of return of marriage, birth or death is made uniform, viz., $20.

II. Section 2 gives authority to all in charge of returns of births to provide and send to each physician twelve prepaid envelopes each year, for the monthly return of births, the expenses to be paid by the usual disbursing officer of the city or township. But the failure of any physician to receive these does not excuse the non-return.

III. Section 3 makes it lawful in cases where there has been sudden death without medical attendance, or where the medical attendant is sick or absent, for another physician to give certificate. This is only meant for extreme and exceptional cases, and the fact of inability to secure from the attendant must be stated on the certificate.

IV. Section 5 allows an undertaker, for his convenience, to procure a permit of burial (where this is required for burial instead of the certificate of death) in the town in which he lives or where the burial is to be made, but as in such cases the city clerk has to mail the certificate of death given him in exchange, to the local assessor, the undertaker is required to pay postage.

V. Section 8 requires the same where the body is to be removed from the State and the undertaker finds it more convenient to get a permit in the town in which he resides, instead of the assessor in whose township the death occurred.

VI. Section 9 is a new section and requires the keeper of every incorporated cemetery to keep a record of interments, open at all proper times to the inspection of Local Boards or of agents of the State Bureau of Vital Statistics. Local Boards should notify each such local cemetery of this law.

VII. Section 15 makes it the duty of the Health Inspector, the Registrar of Vital Statistics and members of the Local Board of Health to enforce the law, and simplifies the mode of recovering the penalty.

In all other respects the act conforms to former acts.

The law is as follows:

CHAPTER XXXIX., LAWS OF 1888.

[Approved February 15th, 1888.]

An Act to secure in this state the certification of marriages, births and deaths, and of the vital facts relating thereto, and to provide for the record thereof.

1. Be it enacted *by the Senate and General Assembly of the State of New Jersey*, That it shall be the duty of every judge of any court of common pleas, justice of the peace, recorder, police justice, mayor, minister of the gospel, and other person who shall, under the authority of any law of this state, solemnize any marriage therein, and the clerk or keeper of the minutes of any religious society before which any marriage shall be solemnized in this state, to transmit to the officer hereinafter designated, within thirty days after such solemnization, a certificate of each and every marriage solemnized by any such minister, magistrate or other person, or before any such religious society, which certificate shall set forth particularly the name, age, parentage, birthplace, occupation and residence of each of the persons married, the time and place of the marriage, the condition of each of the persons married, whether single or widowed, the name of the minister, magistrate or person by whom, or of the religious society before which the marriage was solemnized, and the names and residences of the witnesses; any minister, magistrate or other person, or clerk or keeper of the minutes of any religious society, who shall neglect or fail to transmit such certificate to the officer hereinafter designated, within the time aforesaid, shall be liable to a penalty of twenty dollars.

2. *And be it enacted*, That it shall be the duty of the physician or midwife present at the birth of any child born in this state, and in case there be no physician or midwife present, then of the parents or either of them, to transmit, within thirty days after such birth, to the officer hereinafter designated, a certificate of such birth, which certificate shall set forth particularly, as far as they can be obtained, the day of the month and year of the birth, the township, city or municipality, and the county, in which the birth occurred, the name of each of the parents, the maiden name of the mother, the birthplace, residence and occupation of each of the parents, the sex and color of

the child, the name of the child if it be named, and the name of the attending physician or midwife if any there be; it shall also be the duty of the assessor of every township, and of the clerk or the person acting as registrar of vital statistics in every city, borough, town or other local municipal government, between the first and tenth days of April, in each and every year, to mail to each physician or midwife residing in such township, city, borough, town or other local municipal government, or to supply to every such physician or midwife on application therefor, twelve envelopes of proper size, each with a two-cent postage stamp thereon, to be provided at the expense of the township, city, borough, town or other local municipal government, for the use of said physicians and midwives in transmitting said certificates of birth to the officer hereinafter designated; any physician, midwife or parent whose duty it may be to transmit such certificate as aforesaid, and who shall neglect or fail to perform such duty within the time above limited, shall be liable to a penalty of twenty dollars; and the assessor of any township who shall ascertain that any physician, midwife or parent has neglected or failed to perform such duty as aforesaid, within the time above limited, shall forthwith make and sign a certificate setting forth the particulars hereinabove specified, and shall mark the same with the words "special return," but no such certificate of the assessor and no failure of any assessor, clerk or registrar of vital statistics to mail the envelopes aforesaid, shall release any physician or midwife, or any parent, from the duty of certifying such birth in the manner aforesaid, nor from the penalty incurred by any neglect or failure to certify such birth.

3. *And be it enacted*, That when any person shall die within this state, it shall be the duty of the physician who shall have attended such person during his or her last sickness to furnish to the undertaker, or any member of the family applying therefor, a certificate of such death, which certificate shall set forth particularly, to the best of such physician's knowledge, the name, age, sex, color, nativity, occupation, last place of residence, the township, city or municipality, and the county within which the death occurred, and the cause of death; if no physician shall have attended such deceased person during his or her last sickness, or if the physician who shall have attended such deceased person shall be absent or sick, so that no certificate of death can be obtained from him in time for burial, then and in either of such cases it shall be lawful for any physician to whom

application may be made, after having viewed and examined the dead body, and being satisfied that the deceased person did not come to his or her death by the contrivance, aiding, procuring or other misconduct of any person or persons, to furnish such certificate as aforesaid; in case the attending physician, or the physician applied to as aforesaid, after having consented to act upon such application and viewed and examined the dead body, shall refuse to furnish such certificate as aforesaid, except upon the ground aforesaid, he shall be liable to a penalty of twenty dollars; and if any physician shall refuse to furnish such certificate as aforesaid, upon the ground aforesaid, the same proceedings shall be had as are provided by law for the investigation of the cause of violent, sudden or casual deaths, and the physician or officer who shall conduct such investigation shall furnish such certificate of death as aforesaid.

4. *And be it enacted,* That every certificate of marriage or birth required to be made by the first and second sections of this act shall, in any city, borough, town or other local municipal government, be transmitted to the registrar of vital statistics, if there be such officer, and if not, then to the clerk of the city, borough, town or other municipal government in which such marriage or birth shall occur; and in any township every such certificate shall be transmitted to the assessor of the township in which such marriage or birth shall occur, or if there be no assessor in office, then to the township clerk.

5. *And be it enacted,* That every certificate of death required to be made by the third section of this act, shall, where the death occurs within any city, borough, town or other local municipal government, be delivered to the registrar of vital statistics of such city, borough, town or other local municipal government, if there be such officer, and if there be no such officer, then to the clerk thereof, and said registrar or clerk shall thereupon issue a permit for the burial of the body of the deceased person described in said certificate of death, and shall forthwith give said permit to the person delivering to him the certificate of death, which permit shall be authority for the burial of such body, but the said certificate of death shall be retained, to be disposed of as hereinafter directed; where the death occurs within any township and the burial is to be made in any place in this state not within the limits of any city, borough, town or other municipal government, every certificate of such death which shall be furnished to the undertaker, or other person acting as undertaker, shall of itself

constitute a sufficient authority for such burial; and where the death occurs within any township and the burial is to be made within the limits of any city, borough, town or other local municipal government of this state, every certificate of such death shall be delivered to the assessor of such township, if there be one in office, or if there be no assessor in office, then to the clerk of such township, which assessor or clerk shall thereupon issue a permit for the burial of the body of the deceased person described in such certificate of death, shall give said permit to the person delivering to him the certificate of death, and shall retain the certificate of death, to be disposed of as hereinafter directed; *provided, however,* that when a death shall occur within any city, borough, town or other local municipal government now existing, or which shall hereafter exist, within the limits of any township, then and in such case a permit for burial shall be obtained in the same manner as in other cities, boroughs, towns and local municipal governments; *and provided further,* that when a death shall occur within any township and the burial is to be made within the limits of any city, borough, town or other local municipal government of this state, the certificate of any such death may be delivered, if it be more convenient, by the undertaker or person acting as undertaker, to the registrar of vital statistics, if there be such officer, or if there be no such officer, then to the clerk of the city, borough, town or other local municipal government within which such undertaker or person acting as undertaker may reside, or within which the burial is to be made, but in all such cases it shall be the duty of such undertaker or person acting as undertaker, to deliver with said certificate of death, in writing, to such registrar or clerk, the name and post-office address of the assessor, if there be such officer, and if there be none, then of the clerk of the township in which the death shall have occurred, and also the sum of two cents to pay for postage, and said registrar or clerk shall immediately issue a permit for burial as in other cases and shall immediately transmit such certificate by mail to the assessor or clerk whose name and post-office address shall have been furnished as aforesaid, and for any neglect or failure so to transmit such certificate, such registrar or clerk shall be liable to a penalty of twenty dollars.

6. *And be it enacted,* That in case where, on account of the absence of the registrar of vital statistics or the clerk of any city, borough, town or local municipal government, or for any other sufficient reason,

it may be impossible to obtain from such registrar or clerk a permit in time for burial, it shall be lawful for any judge of the court of common pleas or any justice of the peace of the county in which the death occurred, on presentation of the certificate of death to him, and being satisfied that such certificate is genuine, and that no permit can be obtained in time for burial from the clerk aforesaid, to issue a special permit for burial in the following form: "It being impossible to obtain a burial permit from the registrar of vital statistics or the clerk of the [stating here the name of the city, borough, town or other local municipal government], on account of [stating here the reason], I, a judge of the court of common pleas [or a justice of the peace] of the county of , do hereby grant this special permit for the burial of , whose death has been duly certified to me," which permit shall be dated and signed by such judge or justice; the said judge or justice shall transcribe a copy of said permit upon the back of the certificate of death, shall give the original permit to the person delivering to him the certificate of death, and shall transmit the certificate, with the transcription thereon indorsed, by mail, in an envelope marked "burial permit," to the state bureau of vital statistics, at Trenton; the judge or justice who shall issue any such permit shall be entitled to charge and receive from the person presenting to him such certificate of death the sum of fifteen cents.

7. *And be it enacted*, That in case any person shall die without this state, and his or her body shall be brought into this state for burial, it shall be the duty of the family undertaker or other person conveying such body into this state, to bring therewith, or send beforehand, a certificate of death made by the physician who attended such deceased person during his or her last sickness, setting forth the particulars specified in the third section of this act, or in lieu thereof, a certificate of death, setting forth said particulars, may be obtained from any physician duly authorized to practice medicine within this state, who shall reside within the township, city, borough, town or other local municipal government within which the burial is to be made, and who shall have made proper inquiry as to the facts required to be certified, and satisfied himself as to the same; if the burial of such body shall be made in any township of this state, such certificate as aforesaid shall constitute a sufficient permit for burial; but if the burial shall be made in any city, borough, town or local municipal government of this state, the said certificate shall be delivered to the

registrar or clerk thereof, who shall issue a permit for burial, as in cases where deaths shall occur within the city, borough, town or local municipal government of which such registrar or clerk is an officer.

8. *And be it enacted*, That any undertaker or other person who shall be about to remove from this state the body of any deceased person who shall have died within this state, shall, prior to such removal, obtain a certificate of the death of such person, as required by the third section of this act, and such certificate shall be presented to the assessor of the township in which the death shall have occurred, if there be such officer, or if there be none, then to the clerk thereof, or to the registrar of vital statistics of the city, borough, town or other local municipal government, in which the death shall have occurred, or if there be no such officer, then to the clerk thereof, who shall issue to the person presenting such certificate a general or transit permit, according as the case may require; or, if the death shall have occurred in any township, and it shall be more convenient to present said certificate of death to the clerk of some city, borough, town or other local municipal government, such course may be adopted, but the person presenting such certificate shall, in such case, also furnish said clerk with the name and post-office address of the assessor, if there be such officer, and if there be none, then of the clerk of the township in which the death shall have occurred, and shall also pay to said clerk the sum of two cents, and said clerk shall thereupon issue a general or transit permit as aforesaid, and shall also forthwith transmit said certificate, by mail, to the assessor or clerk, whose name and post-office address shall have been furnished as aforesaid, and for any neglect or failure so to transmit such certificate, said clerk shall be liable to a penalty of twenty dollars.

9. *And be it enacted*, That it shall be the duty of the keeper of every cemetery within this state, owned by any cemetery company organized under any law of this state, to keep a record of all interments made in such cemetery, which record shall include the name of the person interred, last place of residence and the name of the undertaker, or person acting as undertaker; said record shall be a public record and at all times open to the inspection of any persons who, under any of the laws of this state, shall have duties imposed upon them relating to the procurement or tabulation of vital statistics.

10. *And be it enacted*, That it shall be the duty of every undertaker in this state, and of every person acting as undertaker in this state,

to transmit by mail or otherwise to the assessor of the township, or if there be no assessor, then to the clerk of the township, within five days after burial, the certificate of death which he may have received and used as a burial permit in the case of any person who shall have died in such township, or of any person who shall have died out of this state and been buried in such township, and if he shall neglect or fail so to do he shall be liable to a penalty of twenty dollars; and any undertaker, or person acting as undertaker, who shall bury within this state the body of any deceased person without having first received a permit for burial, according to the true intent and meaning of this act, and any clerk who shall sign any permit for burial and deliver the same, or knowingly suffer it to be delivered, to any undertaker or other person, without having first received a certificate of death, according to the true intent and meaning of this act, shall be liable to a penalty of fifty dollars.

11. *And be it enacted*, That any minister of the gospel, magistrate, physician, midwife or other person, who shall knowingly make any false certificate of marriage, birth or death, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be liable to a fine not exceeding one hundred dollars or imprisonment in the county jail for a period not exceeding three months, or both, at the discretion of the court.

12. *And be it enacted*, That it shall be the duty of the assessor and clerk of every township, and of the registrar of vital statistics and the clerk of every city, borough, town or other local municipal government in this state, on or before the fifteenth day of each calendar month, to transmit by mail to the state bureau of vital statistics, at Trenton, in an envelope marked "vital statistics," all the certificates of marriages, births and deaths received by such officer, and of all "special returns" of births made during the preceding month; and every such assessor, registrar or clerk, upon receiving a certificate from the medical superintendent of said bureau of the whole number of certificates of marriages, births and deaths returned as aforesaid, shall be entitled to receive from the proper disbursing officer of the township, city, borough, town or other local municipal government in which such assessor, registrar or clerk shall be an officer, the sum of ten cents for each marriage, birth and death so returned, the receipt for which shall be attached to the said certificate of the said medical superintendent, and no payment shall be made unless such certificate

be produced; and it shall further be the duty of the registrar of vital statistics or the clerk of every city containing thirty thousand inhabitants or over (provided he has been or shall be so directed by the common council or other governing body thereof), before transmitting said certificates to the state bureau of vital statistics, to make a complete record of the marriages, births and deaths occurring in such city, which record shall be a transcript of the names and vital facts appearing upon the certificates of marriages, births and deaths delivered to him as hereinbefore directed; the said record shall be so made up that the marriages, the births and the deaths shall appear in separate and distinct classes, in books of such form as may be approved by the local board of health, and for making such record the said registrar or clerk shall be entitled to receive from the disbursing officer of said city the sum of three cents for each certificate thus recorded, in addition to his other fees and salary.

13. *And be it enacted*, That it shall be the duty of the medical superintendent of said bureau to cause the certificates of marriages, births and deaths received by said bureau pursuant to the provisions of this act, to be alphabetically indexed, and in connection with said index to cause to be transcribed or otherwise recorded from said certificates such of the vital facts appearing thereon as the state bureau of vital statistics may deem necessary and useful; the index to the certificates of marriages, of births and of deaths, with said record of vital facts, shall be kept separate and distinct from one another, and shall further be so arranged as to present in separate and distinct classes the index and record for each county, and for each city, borough, town and other local municipal government containing five thousand inhabitants or over, which index and record thus prepared and classified shall be preserved as a public record in the office of the state bureau of vital statistics, and the original certificates shall be preserved in the archives of the state bureau of vital statistics; any such original certificate, or any copy thereof, certified to be a true copy under the hand of said medical superintendent, shall be received in evidence in any court of this state to prove the facts therein contained.

14. *And be it enacted*, That it shall be the duty of the state bureau of vital statistics to cause to be prepared blank forms of certificates of marriages, births and deaths, and of burial permits, corresponding to the requirements of this act, which forms, together with such sections

of this law and such instructions and explanations thereof as the said bureau may deem useful to persons having duties to perform under this act, shall be printed and supplied in the same manner as the blanks and stationery for the use of the several departments and public offices of the state government are printed and supplied, and shall be distributed from time to time as occasion shall require, by said bureau, amongst the assessors of the townships and the registrars and clerks of the cities, boroughs, towns and other local municipal governments of this state; and it shall be the duty of every such assessor, registrar and clerk to make and keep a complete list, as far as possible, of all ministers, magistrates, physicians, midwives, undertakers and other persons required to perform any duties under this act, and on or about the first day of May of each year to send to each such person a printed copy of such sections of this act and of such instructions and explanations as may be prepared as aforesaid, and also to furnish to each such person, on application, free of charge, a reasonable number of said blank forms as such person may require; and all certificates of marriages, births or deaths shall be made on the printed forms furnished by said bureau, or if they be written shall conform in all respects to said printed forms.

15. *And be it enacted*, That any penalty incurred under any of the provisions of this act, which shall relate to any particular marriage, birth or death, may be recovered with costs in an action upon contract in the name of the local board of health of the township, city, borough, town or other local municipal government, within whose limits such particular marriage, birth or death shall have occurred; and any penalty incurred which shall relate to any particular burial, if the death occur in this state, may be recovered in like manner in the name of the local board of health of the township, city, borough, town or other local municipal government, within whose limits the death shall have occurred, but if the death occur without this state then such penalty shall be recovered with costs in an action upon contract in the name of the local board of health of the township, city, borough, town or other local municipal government within whose limits such burial may have been made; it shall be the duty of any health inspector, registrar of vital statistics or member of any local board of health, who shall know or be informed of any violation of this act, whereby any penalty may have been incurred, to make, under oath or affirmation, a complaint against the person incurring

such violation, setting forth the facts of such violation, and to file such complaint with the clerk of any district court or any justice of the peace, police justice or recorder of the township, city or municipality within which the local board in whose name the suit may be brought shall have jurisdiction, and the clerk of the district court, the justice of the peace, police justice or recorder with whom any complaint shall be filed as aforesaid, setting forth facts sufficient to show that any penalty prescribed by this act has been incurred, is hereby authorized and required to issue process, either in the nature of a summons or warrant, which process, when in the nature of a warrant, shall be returnable forthwith, and when in the nature of a summons shall be returnable in not less than five nor more than fifteen days; on the return of such process, or at any time to which the trial shall have been adjourned, the said court, justice of the peace, police justice or recorder, shall proceed to hear the testimony and to determine and give judgment in the matter without the filing of any pleadings, and if judgment shall be given in favor of the plaintiff, execution shall be forthwith issued against the goods and chattels and person of the defendant for the amount of the penalty with costs; the officers to serve and execute any process of execution issued as aforesaid, shall be the constables of the county, which service and execution shall be made in the same manner and under the same liabilities as prescribed in cases of the service and execution of process and executions by the act entitled "An act constituting courts for the trial of small causes" and the supplements thereto; all moneys recovered in any such action shall be paid to the local board of health in whose name the suit may have been brought, for the uses of such board.

16. *And be it enacted*, That all acts and parts of acts inconsistent with the provisions of this act be and the same are hereby repealed, and that this act shall take effect immediately.

Approved February 15th, 1888.

The attention of all those concerned is especially drawn to the Circular Letters herewith, marked (A), (B) and (C).

CIRCULAR LETTER (A).

STATE OF NEW JERSEY,
BUREAU OF VITAL STATISTICS,
TRENTON.

The necessity of a State record of every marriage, birth and death, the legal rights of those concerned, and the penalties for neglect of returns are such that omission to obey the law may at any time cause you both difficulty and expense. We shall hereafter take it for granted that all know the law. Returns should be made in ink, and care used as to dates. All city clerks and assessors can, at any time, supply blanks or any needed information, or a postal directed "Bureau of Vital Statistics, Trenton, N. J.," will bring reply.

Neglect of returns of birth may, at any time, embarrass as to proof of age, parentage, pensions or other legal inquiries, and also cause a defect in those accounts of population which are kept in the interests of social progress and of the public health.

Neglects as to returns of death often cause the greatest legal complications, and are absolutely necessary to enable us to deal with questions relating to the health of the people and the public welfare.

For the good citizen it is enough that the law requires these returns, while all those who study the great questions relating to population and national progress recognize their indispensable utility.

CIRCULAR LETTER (B).

TRENTON, N. J., March, 1888.

GENERAL CIRCULAR AS TO DUTIES UNDER THE LAWS RELATING TO VITAL RECORDS AND STATISTICS.

To Clergymen, Justices of the Peace, &c.

It is not only a breach of law, subjecting you to penalty, but a risk to the personal rights of individuals to neglect the return, within thirty days, of a marriage certificate to the assessor of the township

or city clerk of the city in which the event occurs. Blank forms can be had of the assessor or city clerk, or through postal addressed, "Bureau of Vital Statistics, Trenton, N. J."

To Physicians, &c.

Returns of births are not only required by law, but essential to that right of record which is thus secured to every child. Birth-rates and death-rates are needed for comparisons, in order to know sanitary conditions. The returns to assessor, or city clerk, must be made each month. Your promptness will greatly aid us in comparisons. Blanks can always be had of assessors or city clerks, or through postal addressed, "Bureau of Vital Statistics, State House, Trenton."

N. B.—See law that physicians must have their diplomas on record in office of county clerk. Certified list will be printed.

To Undertakers.

You are aware that the *burial* of any person by you without a permit is contrary to law. A failure to find the record often obscures legal claims, and may subject you hereafter to great risks. Where the *death and burial* are in a township outside of city limits, the certificate of death answers as a permit. Delay to obtain the certificate until after death, and burial without a permit must not occur. All plausible excuses do not answer the one fact that the State ought to and does say that no human being shall be put under ground without a responsible certificate as to cause of death, &c. Assessors, clerks and local boards of health must report any negligence to Bureau of Vital Statistics, Trenton, N. J., or bring action if necessary.

City clerks will please note chapter XXXIX., section 5, Laws of 1888.

To City Clerks and Assessors.

This Bureau has sent notices to secure prompt returns to all physicians, clergymen and undertakers. Under the law, any negligence, with the name and address, must be reported to us. The general law as to vital statistics gives full power, also, to Local Boards. These returns are essential as records, and for the study of local evils, and of the means to protect the life, health and welfare of our population. The full success of some cities and townships shows that local defects

in returns are not the fault of the law, but result from negligence or want of judicious oversight.

Order blanks of Bureau of Vital Statistics, Trenton, N. J., *before* you are out, so that none may complain.

CIRCULAR LETTER (C).

The attention of the Medical Superintendent of Vital Statistics has been called to the fact that although returns reach this office they are often made so long after the time provided for by law as to make imperfect the returns for cities for any given week or month, and also so as to seriously delay the indexing at the central office. Still more serious is the fact that *undertakers* have buried *in some cities*, on the certificate of death instead of the permit, and even in a few cases have buried without either, on the promise that they will make the return. While this return is afterward made, so irregular a mode of interment can no longer be tolerated. Recently an investigation showed six burial certificates in the hands of one city undertaker, which he had arranged to send to the city clerk some time after the burials took place. *All undertakers* are now cautioned against any such delays or irregularities under penalty of the law. Boards of Health are requested to at once proceed against such violators of their ordinances. All keepers of cemeteries are warned against allowing burials before presentation of the required permit, or of the certificate of death if the death or proposed place of burial is within city limits. If any case of refusal of burial hereafter occurs, the undertaker will be held responsible, both by the courts and by the friends who suffer by the delay.

E. M. HUNT,

Trenton, March, 1888. *Med. Sup't S. V. S.*

THE PASSAIC RIVER AS RELATED TO WATER-SUPPLY AND DEATH-RATES.

BY E. M. HUNT, M.D.

The question of a pure water-supply is alike one of personal and public health, and of material prosperity. When once it comes to be known that the wells or the reservoirs of any locality cannot supply water fitted for drinking purposes, there is peril to the health of inhabitants, as well as an inducement afforded for them to move away, and for other persons not to settle in that district.

There are two fundamental questions which meet us at the start.

(*a.*) What constitutes a water-supply fitted for drinking purposes?

(*b.*) What are the risks or effects of a supply that does not answer this condition?

We answer the first question as follows:

First of all, it is not required that a water-supply fitted for drinking purposes be absolutely pure. It does not have to answer the chemical definition of pure water. We have a standard of pure water in rain coming down at places (as on the sea) where in its descent it does not encounter any organic matter, but it is not required that only such water be used. By a knowledge of standards, we come to know not only the standard of purity, but what variations are permissible. Thus, as to inorganic matters or such as fire will not destroy, we know, for instance, that a very little lime may be in water without ill effect, and so know the significance of various mineral compounds both as to their kinds and as to their degrees. So we come to know that living animal or living vegetable matter of certain kinds and of certain quantities is not injurious. As to dead vegetable matter we know that its effects depend upon quantity and quality and upon such conditions of heat and moisture and of individuals as may cause it at one time to be neutralized or overcome, and at other times to undergo forms and degrees of decomposition which are riskful or absolutely harmful.

The same is true as to animal matters, which, as a whole, are more hazardous than vegetable matters, but which also vary as to the effects of quality or quantity and as to whether they undergo what may be called natural decompositions or those which are more putrefactive or exceptional. The same is still more true of animal excretions and secretions, which are still more prone to rapid putrefaction or specific changes which incline to produce disease. One thing was long since settled and has never been contradicted, "water-supply should be uncontaminated by sewage. There is no demonstrable safety in a middle course. No one has conclusively shown that it is safe to trust to dilution, storage, agitation, filtration or periods of time, for the complete removal of disease-producing elements, whatever they may be."

The presence of soluble vegetable matter is to be avoided more, however, on account of the unpleasant color and sometimes odor, which is thereby communicated to the water, than from its injury to health. This must not be confounded with vegetable matter in course of decomposition, which is considered to be injurious and at all times to be avoided.

By knowing what pure standards are and by a knowledge of the laws of inorganic and organic materials, of living and of dead matter, and by experiment and experience, we come to formulate rules or to arrive at conclusions as to what is safe or unsafe, what is innocuous and what is harmful. Two things can be said as to the knowledge thus acquired.

(*a*.) Although for a time there may be disagreement as to facts, and although for a long time there may not be agreement as to all details, yet the knowledge thus far secured is as a rule such as commands the general consent and belief of those most capable of knowing and of a sufficient number to justify us in receiving their conclusions rather than accepting the doubts and unbeliefs of those who have never investigated this particular subject.

(*b*.) The cautions and precautions used by such have generally been those that justify us in accepting their views so far as they regard them as determinate.

We therefore, first of all, claim that where the uniform testimony of chemists and of those who have made collateral scientific, technical experimental investigations, affirms that a water-supply is not fit for drinking purposes, this is a kind of testimony to be accepted and not in anywise shaken by the contrary opinion of those who have not

and cannot apply any such tests. We do not say this is the only kind of evidence, but it is a kind not to be set aside by any promiscuous, off-hand opinions. The *second evidence* is that derived from actual effects.

As the findings of science and the findings of experience should agree sufficiently often to establish the claims of either, it would be well if always the one could be tested by the other. But if so, the trial must be as exact and as void of sources of error in the one case as in the other. Thus, if we would test by experience, a water the chemist has declared unfit for drinking purposes, as carefully in this human laboratory as he has in his laboratory, we would select a hundred children between one and five years of age in that period of the year in which changes of decayable vegetable and animal matters are most likely to take place, and would give to these children full and frequent doses of this water and watch its physiological effects with the greatest accuracy and make precise record of all facts. It is because of the risk of such experiments to human life, that long ago hundreds of such experiments have not been carried on under conditions that would exclude other more general, exciting or *neutralizing* causes.

It is because of our inability thus to test, that what is called *experience* is so mixed up with other influences that we find it difficult to rely on the general unclassified opinions of physicians who cannot easily collect the evidence in such way as to be able to analyze it. Hence, we find equally competent men (if they can be led to give any opinion), side by side, giving the most diverse opinions as to the effects of this or that food or drink, really because neither, under the circumstances, could have been expected to give any *expert* opinion at all.

To this, however, there may be an exception. When, year after year, the general death-rate or sickness-rate of a place is beyond what is regarded as a fair average, say fifteen per thousand, when it occurs especially at certain ages known to be susceptible to alimentary influences, and when it belongs to species of disease known especially to be related to decomposing and putrefactive changes, there may come to be such cumulative evidence and such exclusion of other factors as afford a large probability as to the cause—enough to be the ground of action. This is all the more conclusive if there are cases where the chemists and others show a bad record as to sickness to have existed, and that it was changed by the withdrawal of one water-supply and the substitution of another.

This is still more strengthened, if certain special and specific diseases can be traced, or have been traced, to the fouling of a water-supply with such exactness as that both the scientific and the chemical investigators agree as to the relation of the drinking-water to the disease.

When any or all of these facts are in evidence, very great consideration is to be given to what is the common consent and common observation and belief of those who, with skill, have made technic *examination* or have, in their *observations*, fulfilled such conditions as make of them skilled observers.

There is another argument that is not to be lost sight of. If a teaspoonful of compost or excrementitious matter of any kind, or a teaspoonful of urine, is put to every pint of water in the water-holder from which I am to drink, the general principle, the common instinct and the general sentiment, which is not sentimental, but derived from experience and observation, and the testimonies of science, are, that such water is not intended for food or drink. It is not that we need so much to look at any one proof, as at the very system basis of life and the organic law of all existence.

Surely, in such a case, the burden of proof that it is harmless is with those who are in contrariety to the principle of nature. The only limitation to this argument is, that there are in the processes of dealing with decomposable material, laws of restoration or neutralization. The operation of these, however, needs to be proven.

But these laws are within the reach of our ken, so that we know whether they have really been brought into operation. If so, we can test and prove it by analysis and by comparisons of the state of the water where, or at the time this material is introduced, and after heat and moisture have affected it, or after the lapse of some time, or after great distances of flow have changed it. We do, fortunately, find that such recovery does take place within certain defined limits and under certain given circumstances. But until this is positively shown to have taken place, the safe rule is, that we are not to drink of that which has been polluted, since such recovery so often fails to take place.

With these facts before us as guides, are we not in a position generally to determine the quality of a water-supply? There are tests of appearance; often of taste and smell, and oftener still of chemistry, and some approximate tests of biology, and too frequently death-rates and sickness-rates and special seizures that show the con-

dition of water-supplies as their most probable explanation—so much so that they are accepted as such by the great majority of those who have most thoroughly fitted themselves for correct judgment and conclusions.

We proceed next to our second question, "What are the risks or effects of a supply that does not answer to the conditions required for a proper quality of drinking-water?"

The answer in part comes from what water is and what it does in the system. Pound for pound it is taken into the system more than food. It permeates and penetrates every part. It so far makes up the bulk of the human system that the body has been defined to be a few pounds of flesh amid six pailfuls of water. Now, first of all, the system will not perceptibly or intensely sicken under ordinary and repeated defilements of water any more than every wrong food or wrong use of it will make a record in ill-health. Nature meets forces of evil with forces of good, and even so far overcomes as to make that which is evil seem often harmless. But there has been expenditure of vital force in the act which had far better been utilized in some other direction. There is wastage of force and of energy in every unnecessary tax upon vitality, recording itself far oftener in a slight reduction of vigor or even in a manifestation of irritated and spasmodic force or temporary ailment, than in an abbreviation of life, which, even when it occurs, does not occur at the beginning or middle or at the time of infliction, but only at the end, when the measure of the imprudence is full. Thus, because the result is not immediate, but records itself too often by making sixty instead of seventy the limit of life, we lose sight of operating causes.

Those who have been close students of this phase of influence have not only convinced themselves but been able to show to others the limiting and disturbing influences of a poor water-supply. The evidence is made quite apparent in the records of the Local Government Board of Great Britain and some of the vital statistics of Dr. Farr. Prof. De Chaumont, in his lectures on "State Medicine" (1875), in detail and by diagrams shows the coincidence of disease with water impurity. Dr. George Wilson, of Leamington, in his Handbook of Hygiene has a valuable chapter on "Impure Water and its Effects on Public Health." The coincidence of severe cholera epidemics with a water-supply proved to be polluted has been shown in numbers of instances beginning with the investigations of Dr. Snow in 1849, and

oft repeated up to the fearful supply of Marseilles in its recent cholera visitation. The relations of typhoid fever to water-supply have been constantly illustrated from the time of Murchison to the present. The North Boston case of Dr. Austin Flint, the Plymouth epidemic and some lesser ones that have occurred in our State have sufficiently illustrated this. Of the less specific forms of diarrhœa and dysentery, the case of the Salford jail, where only those were seized who had used the one supply, while all using another escaped, as well as the six outbreaks selected from the government reports, point to the water as the cause. It would require a volume to report the multitudes of cases in which an imperfect water-supply has been reasonably shown to have caused both general and specific maladies. While oftener there are co-operating influences, this one has been sufficiently prominent to have satisfied the general judgment and experience of practitioners as well as of those who in the laboratory have verified their beliefs. These are scattered through the sanitary literature of the past twenty years, while the improvements caused by the introduction of pure supplies like that of Loch Katrine at Glasgow have been verified in many other instances.

THE PASSAIC RIVER AS AN EXAMPLE.

Perhaps this mode of securing evidence, and the reasons for making deductions therefrom, and consequently for securing a better water-supply, cannot be better illustrated than by taking as an example that river in our State on which more than any other dependence is placed for water-supply to large populations.

PASSAIC RIVER AS A WATER-SUPPLY.

We, therefore, proceed to inquire as to what are the evidences as to the fitness or unfitness of Passaic river as a source for drinking water. Our first inquiry is as to its natural fitness. It may be said, in general of all rivers, that inasmuch as they represent to a large degree surface-water and imperfect percolation, and are readily accessible for pollution, that they are not to be looked upon as usually the best sources of public water-supply. So true is this that Dr. Sanders, of London, in an article on the "Purification of Rivers" in the Transactions of the Society of the Medical Officers of Health, 1886–7, says:

"That water-supplies are now throughout the country largely taken from independent sources, and the rivers abandoned for domestic supplies."

Next, there are especial reasons why the Passaic and some rivers similar thereto are to be criticised in choice of water-supply. It is a river which in its upper tributaries and in the impediments interposed by ledges of rock and dams naturally acquires a great deal of vegetable material and sediment. No one who has traced the portion of it above Little Falls that does not know that to a very small degree does it answer the ideal of a mountain stream. The inundations and their deposits, the backward flow of miles, and the small grade of flow at best diminish its self-purifying properties. As we come further down, we find it to be inevitable that large populations must be gathered here and there upon its banks and factories of various industries, and that its course to the sea must be amid great meadow-flats and with no rapidity of flow. So, it is one of those rivers which engineers would not, on general grounds, choose for a supply. Even its use as a general sewer is far more defensible than the use of the lower portions of it for a water-supply.

Next in point is the consideration of the chief sources and the degree of pollution of this river at or near points where it is depended upon for a water-supply.

It is to be remembered that pollutions coming from any city are of varied character and very large amount. To go into an accurate calculation we would need not only to know how much is the excrement of all kinds and the results of all decay from every being, animal or human, but also all that is derived from mineral, animal and vegetable materials that rains sweep into the river and all the waste of all the factories and of every process of decay and the changes it has undergone or can undergo.

The amount of excreta, solid and fluid, of 100,000 people is not overstated at 300,000 pounds every twenty-four hours, or 150 tons per day, or 4,500 tons a month, or 54,750 tons a year. Add to this all decayable and fermentive matter, all laundry and utensil wash, all the pollutions of water as used, all the refuse of slaughter-houses, of factories, of offensive trades and all those complications made by disease and by the storage of foulness and consequent multiplication of risk, and we have an aggregate of befoulment that intuition, primary belief, experience, science and art unite in saying should not go into

our pitchers or our drinking-cups or our stomachs. Even with very large dilution and with some diminution through natural processes, it is *too large a hazard* for civilized people if any other water is to be had. When you multiply all this by the hundreds of thousands of *present* and what ought to be prospective populations, there is an urgent case before us for arbitration and verdict. The three embarrassments that are involved are disease, death and financial disaster.

As we turn to the banks of this river below Little Falls, we find at Paterson about 60,000 people besides all other animals and all other sources of befoulment; at Passaic, 9,000; at Newark, 160,000, with a population in Jersey City and suburbs of 200,000, receiving the same supply. With this is to be reckoned some of the scattered populations along the banks, as well as pollutions from Saddle river and the towns along Third river and those along Second river, as well as what is carried up by the tides.

Paterson has about thirty miles of sewers. The flow of Passaic city is to the river, and they are now proposing to build sewers to conduct it more directly.

The Third river bears into the Passaic the refuse of the several factories and of the Morris canal, as well as some of that of the scattered population near it. All this enters about one mile and a quarter above the Newark in-take.

The Second river brings down the sewage of Orange, Bloomfield and other towns and villages in close proximity, and empties about one-quarter of a mile below the Jersey City in-take.

In addition to all this, the sewage of the city of Newark, to a serious degree, is forced up above the Jersey City in-take, and so as also to affect the parts above Newark in-take.

The more the facts have been examined into, the more it appears that the sewage of 250,000 people, with all that it means as to other refuse, garbage, &c., is likely to find its way into the Passaic river. The flow of the Passaic river is stated by Howell & Croes (p. 35) as 126,334,000 gallons per day at Paterson when the streams were low (October, 1878), so that as to the water of Jersey City, one of the chemical experts (Prof. A. R. Leeds) says: "I am within the limit when I state that fifty per cent. or one-half of the organic matter in the Jersey City water during the year 1884, was sewage." More recent analyses have shown increased pollution.

Thus it appears that the Passaic river is forever to receive into its

waters a very great amount of impurities of various kinds, and the very grave presumption is that its waters are so greatly mixed with sewage as to be unfit for drinking. But inasmuch as it is admitted that distance of flow has effect in refreshing or cleansing water, attention needs to be given to the fact that as to the Passaic, the pollution is so great in relative quantity, and so much of it takes place in the vicinity from which the supply is drawn, that we could not expect sufficient cleansing from this source. The facts as to the localities of these sewage inflows have already been given.

We now turn to the evidence to be derived from chemical investigations and analyses. We do not here discuss all the criticisms made as to the significance of chemical analysis. It can be said in general that the chemist does not lose sight of other proofs that generally become apparent in the analysis besides that of the proportions of different kinds and states of organic matter.

It must also be said that while it is admitted that chemistry does not show all the badness there may be in water, and does not fully reach certain questions as to specific microbes, it does indicate those conditions without which destructive life is not likely to exist in the water. It can also be said that where water is found to answer chemical tests, it has never been shown to be the cause of disease. Chemical defects in water do not exhibit all its evils; just as is the case with carbonic acid in air. But it has been found to be so indicative as to the presence of organic matter as to be one of those indices which unfailingly puts out a danger signal. Even where there is danger it does not, in telling quantity of foreign matter, or its general quality, tell all as to possible conditions of forced and virulent decompositions. It, therefore, is not the perfect measure of ill effects, which may vary according to freshets, to seasons of the year, to temperature, to humidity, to quality of filth, to exposures, to acclimation, &c.; but it does tell of such hazard as it is unwise for any to take, and such as is sure to become, from time to time, an infliction to some of those exposed thereto.

We therefore ask, What has been the testimony of chemists or engineers as to the character of this Passaic water, and whether their varied testimonies are in general harmony?

The general standard of purity for river waters in the United States, with allowable limits, is as follows:

	GENERAL STANDARD OF PURITY For River Waters in the United States. (Highest Upper Limits.) Parts per 100,000.
Free ammonia	0.001 — 0.012
Albuminoid ammonia	0.01 — 0.028
Required oxygen as determined by permanganate	0.35 — 0.50
Required oxygen as determined by silver	(?)
Nitrites [HNO_2]	0.0001 — 0.001
Nitrates [HNO_3]	0.35 — 0.50
Chlorine	0.30 — 1.00
Hardness	5 for soft — 15 for hard.
Total solids	15.00 — 20.00
Oxygen dissolved per liter	(?)

The standard taken for Passaic water, as derived from analyses of its upper waters, by Prof. A. R. Leeds, for 1883, is as follows:

	PASSAIC STANDARD OF PURITY. (From analyses of its Upper Waters for 1883.) Parts per 100,000.
Free ammonia	0.005
Albuminoid ammonia	0.015
Required oxygen as determined by permanganate	0.40
Required oxygen as determined by silver	0.32
Nitrites [HNO_2]	Trace.
Nitrates [HNO_3]	0.35
Chlorine	0.35
Hardness	3.00
Total solids	6.00
Oxygen dissolved per liter	5.5 cc.

We believe it is admitted to be a fair standard. Now, the recognitions of pollution, as existing and as increasing in the Passaic river, reach sufficiently far back, and have been attested by a sufficient number of experts to leave us in no doubt as to their general and united judgments.

The Geology of New Jersey, Geo. H. Cook, as published by the Board of Managers of the Geological Survey, 1868, gives an analysis of the Passaic water made in 1851 by Prof. E. N. Horsford, in comparison with the Schuylkill, the Croton, Cochituate and some others; and says the comparison of the relative amounts of solid matters, organic and inorganic which it contains, with those of various other waters in this country used for the supply of cities, shows the Passaic river water to be inferior to the best and superior to some in good repute.

At that time the population of the State was 906,096; of Paterson (1870), 33,579; Passaic below 4,000, and that of Newark, 105,059; that of Jersey City, 82,546.

So late as 1873 a chemical report made by Prof. Henry Wurtz, for the city authorities of Jersey City and Newark, did not show any great deterioration of the water-supply. It must, however, be borne in mind that chemical analysis was less specific at that time than now, and did not so discriminate between the qualities of matter present, and did not so fully know its real significance.

In 1875 the report of the State Geologist speaks thus: "Both Newark and Jersey City get their present supply by pumping water from the Passaic, only a short distance above the former city. This water is of questionable purity. The city of Paterson, with its 33,000 inhabitants, is only thirteen miles above Newark, and all its sewage is discharged into the Passaic, and the country from Paterson to Newark is very thickly settled, and the river receives all its wash and drainage. The sewage of Newark, too, though emptied into the river lower down, is yet carried by the rising tide almost, if not quite, to the pumping works, so that it may help to pollute the water pumped to supply these cities." He also states that the smell of the water in warm weather is against the assumption that its large dilution and length of flow have so oxidized the sewage as to render it safe. In the same report Profs. Henry Wurtz and A. R. Leeds are quoted as believing it still safe for use, while Prof. Cook and Gen. E. L. Viele showed that it was too impure to be safe. (See discussion New Jersey Sanitary Association, 1875, in Second Report, 1878, of New Jersey State Board of Health.) In the meeting of the association, 1877, Prof. Leeds alluded to the makeshifts for the evils of Passaic water-supply, "such as the present plan of a dam across the Passaic at Belleville."

In 1876 analyses of water from the Newark and Jersey City pump works were made at the Geological Survey laboratory at New Brunswick, and compared with water further up. The report in comment thereon says:

"The unusually large amount of volatile and organic matter in the solid substance connected with these waters, together with the knowledge of the sources from whence it is derived, is strongly against its character and desirability for domestic and household use."

In 1876 the anxiety as to the increasing pollutions of the Passaic

river led to a meeting in Newark, in the early part of the summer, "to consider the question of water-supply for the cities and towns in the counties of Hudson, Passaic, Essex, Union and parts of Bergen and Middlesex." A committee was appointed to collect information, and the aid of the Managers of the Geological Survey was invoked. The State Geologist's Report for that year, beside much other valuable information on the subject, says: "The present supply for Newark and Jersey City is drawn from the Passaic near Belleville. This stream receives the sewage from Paterson, a city of nearly 40,000 inhabitants." It then alludes to the higher flow of the tide by reason of the clearance of the channel by the United States government. Analyses of the Passaic water at various points are given. The report alludes to recent great improvements in the chemical analysis of water. While careful in its deductions it points to the correspondence of results with known facts as to the increasing pollutions, and sums up thus: "Water contaminated by filth and sewage, however offensive it may be, is not always, or even generally, *poisonous.* But it is never safe to be used for domestic purposes. In hot weather the organic matters in it decompose rapidly, producing new and unwholesome substances, which are frequently the causes of sickness and death. Diseases, such as typhoid fever, cholera, &c., are conveyed by drinking-water to an extraordinary extent, and exposure to air and oxidation destroys them very slowly. Even freezing does not always destroy organic poisons in water."

The report of 1878 again recurs to the subject, and concludes thus: "At Belleville the sewage from Newark and the salt water from the bay are liable to come up with the flood-tide and pollute the water, and at all times the sewage and manufacturers' waste from Paterson and Dundee run into and mix with the pure river water. On account of these sources of impurity, uneasiness and distrust are continually expressed in regard to the quality of water from this part of the river. And this has led to many inquiries for an available supply of unquestioned purity." Attention is then directed to various and abundant sources. The report says an attempt to secure it is "altogether feasible and economical and cannot be begun too soon."

In the following year (March, 1879) we get valuable information on this subject from a special report made to the Newark Aqueduct Board by J. J. R. Croes, C.E., and George W. Howell, C.E., in

compliance with a resolution of said Board, passed June 5th, 1878, "to ascertain the relative cost and value of various schemes for furnishing an additional supply of water to Newark." While it was not the chief design of this expert committee to set forth facts as to the present character of the water-supply, the fact of its appointment showed the sense of the need, while the facts they present as to the area of population to be provided for still further urged its importance. In this report they accept the fact that the sewage pollution is known to occur, and say that "the result of the careful investigations on this subject, which have for many years been in progress in Europe and America, is expressed in the common assent of all authorities that water-supplies should be uncontaminated by sewage. In addition to the population already noted, they point to the various serious pollutions from certain specified manufactures. For instance, in the various woolen factories, the grease and dirt removed from the wool is about one-third of the weight of the wool treated. As to a mill-race at Paterson receiving the discharge from several factories, they say: "The effect of the impurities discharged into the race was very apparent at its outlet into the river. The water issuing from it was full of foul-looking matter in suspension, and offensive to both sight and smell. It was apparently much more offensive than that issuing from the main sewer of Paterson, close by." Thus, one after another, they recount the sources of pollution, especially those from factories as existing at that time. It is still true, as quoted by them, that "among the numerous processes for the cleansing of polluted water with which we have been acquainted, there is not one which is sufficiently effective to warrant the use for drinking-water of water which has once been contaminated with sewage or other similar noxious animal matters." Satisfied of the necessity of some other source of supply, they then with great care present the various sources from which an abundant and satisfactory supply can be secured.

Just about this time the project of driven wells came into great prominence, and Newark hoped that it had solved the problem of water-supply without resort to any of the proposed supplies from the more northern portion of the State.

Thus, the Geological Report for 1880 says: "The Newark Aqueduct Company is drawing a large part of the water-supply for that city from driven wells in the vicinity of their pump works on the Passaic river flat, a mile north of Belleville. A published report puts

the quantity daily pumped from them at 5,000,000 gallons, and the quality of the water is satisfactory." But as this was merely Passaic water drawn off along the shore, and as the quantity was not maintained, it did not afford the hoped-for relief. When, in 1882, the patentee of these wells asked for a financial consideration, they were abandoned. Besides the watchful inquiry maintained by the Newark Aqueduct Board and some chemical examinations made from time to time, in 1881 it secured the services of Prof. A. R. Leeds as chemist to the Board. It evidently did this determined while having no other source of supply to keep itself informed of the varying qualities of the water and as determined to leave no means untried to guard this supply so long as it had to be depended upon by the people of Newark and vicinity. Prof. Leeds' first report was made to what was then termed "The Board of Inspection of the Pollution of the Passaic River and its Tributaries."

In his first report, November, 1881, Prof. Leeds gave large consideration to the oxidation and purification of the water in its thirteen miles' flow from Paterson, and concludes that the pollution of the water used for the supply of Jersey City and Newark was derived mainly from the sewage of Newark, which was carried up the stream with the salt water at every flood tide and carried directly in front of the pumping works of both cities. He speaks of it as a "tolerably wholesome drinking-water." He concludes that the evil effects from Paterson do not require action as urgently as the impurities introduced lower down; that if these were kept out a great improvement would be noted, and that it is imperative to keep back the up-tide. Nevertheless, a sanitary patrol of the upper stream was wisely exercised.

In his second report, December 27th, 1882, the chief additional point brought out is the varying condition of the water at different times, since from the December previous a system of regular monthly analyses had obtained. In "February and March the water arrived at its condition of greatest purity." From "September to October of the present year the water rapidly deteriorated and reached its worst point in the latter month." It is spoken of as in that month having attained "a lamentable degree of impurity." He attributes this to a prolonged drought in the autumn of 1881, so that "even up to the month of December the water had not returned to nearly as satisfactory a condition as it was on June 20th, 1881." After attaining its maximum purity in the months of February and March, "the water

remained of excellent quality until the month of May, when the water had so far deteriorated as to contain 0.0245 parts per 100,000 albuminoid ammonia, and passed from the category of pure to that of impure waters. The deterioration in the Jersey City water was still more rapid and decided." In November and December Newark water had again passed into the category of pure water. The poorer character of the Jersey City water is attributed chiefly to the fact that it receives more of the tidal sewage. It did not recover until December. The report, while as apologetic as possible, is true to its figures. These facts no doubt had their influence upon the appointment by the Legislature of 1883, of a State Water-Supply Commission, which it is well known had its origin from the interest felt in a new water-supply for Jersey City and other localities dependent upon the Passaic. Their duty was "to determine upon plans for the storage of any of the waters of this State for the purpose of furnishing to cities and towns a joint water-supply." This commission did not, therefore, devote itself to inquiries into pollutions, although it became more and more informed as to them in its investigations. The first and second reports related mainly to legal questions and the importance of maintaining the natural water rights of the State. The third report, March, 1884, first dealt with plans in outline. It showed the present needs of about 500,000 people, and the call for a daily supply of 37,331,296 gallons, as well as the prospective demand and present rates of increase. They presented various sources, giving preference to the Pequannock source, and showing its economy and feasibility. In the meantime, the third annual report of Prof. A. R. Leeds to the Board of Inspection of the Newark Aqueduct Board, was rendered December 30th, 1883.

The monthly chemical analyses had been continued.

In January of that year the water was pronounced of excellent quality. "This excellence was attained only once during the entire year, falling below the standard in February, and remaining so. The samples taken at the office of the Jersey City Board of Works and at Avondale were in January better than those of Newark, and afterward showed a similar lowering of quality. There was a sudden deterioration in February, attributed to the closure by ice, and varying during the summer, reached its maximum in October. The defilement of the Passaic just below Paterson was then greater than the pollution at the Newark in-take, showing that there had been oxidizing and counteracting influences, but not enough to purify the water.

In March, April, May and June comparisons of Newark and Jersey City water showed that the influence of the Newark sewage reached only as far up the river as the Jersey City in-take, so that the quality of water was not owing to tide, but to the sewage coming down the river. The sewage brought up by the tide always affected the Jersey City in-take most, except in one month of great drought and lowness (September, 1881).

Although always below the standard, except in January, the water is claimed as better than previous years, credit therefor being given to the measures adopted by the Joint Board of Pollution, to restrict and prevent the contamination of the stream. Yet, with all this, it is admitted not to be satisfactory. In his report for 1884, Prof Cook again urges the great importance of securing a supply, "only sixteen miles distant, at an elevation which would carry it to the top of every house in the area sought to be supplied, and sufficient for a population of 2,000,000."

The report of the Newark Aqueduct Board for 1884 claims some slight improvement as compared with 1883, which is thought to have resulted from the various efforts of the Board. But it shows no diminution in the amount of pollution at Paterson, Passaic or Dundee, and claims but the same proportion of one-third, and two-thirds of pollution as coming from the upper river and from the Newark sewage. It is then proposed to make the Passaic water satisfactory—

1. By requiring manufacturers and communities to subject their sewage to such a degree of purification as would return the effluent water to the Passaic, with at least 50 per cent. of its organic impurities removed.

2. By relying on the power inherent in a flowing stream to purify itself after a sufficient number of miles of flow.

3. By constructing at the pumping stations themselves, apparatus for purification.

The first of these has never been put in operation. The second of these had already been shown far from being adequate. The third is a method that has, as yet, not been generally adopted. The whole report of the Board for 1884, while recognizing the water-supply not to be satisfactory, "regards the question of a new water-supply for the cities of Newark and Jersey City as one, the discussion of which would be futile, and so holds out a hope of recovering a polluted stream by various devices." The Geological Report for the

same year, on the other hand, urges a new supply as the only resort, and the Report of the Water Commission shows its great economic and practical feasibility. Before this, the Report of the State Board of Health had been emphatic as to the needs. Besides allusions and facts as to water-supply in previous reports, in 1882 it had said: "The two largest cities of the State, and much of the thickly-settled surrounding country, derive their supply of water from a stream defiled by the emptyings of manufactories and sewers for miles above the point at which it is drawn. This condition of affairs must continue to grow worse, since the natural growth of the communities increases alike the demand for pure water and the contamination of that upon which they depend."

The report of 1883 again alludes (page 11) to these needs, while the report of 1884 speaks as follows:

"The most serious question is that which relates to the supply of large cities, especially those which, by reason of level position or nearness to tide-water, are not likely to find an abundance of potable water near at hand. Within thirty miles of New York city is to be found half of the population of the State of New Jersey. Of this number, according to the careful and discriminating judgment of engineers, chemists, physicians and boards of health, not one-half are supplied with water fit to drink. It cannot be claimed that the unfitness of the Passaic river, as a water-supply, is any new fact, although the rapidly-increasing population magnifies the greatness of the evil. Long ago the State Geologist and various local correspondents pointed to the facts in evidence. Chemists and others, who have begun investigations with the idea that the evils have been magnified, or that they could be remedied by local action, have forsaken such views. The State Water Commission and the chemist of the water boards fully substantiated views already entertained. Nor is it enough to point to the fact of no very great mortality. When so great a city as London can point to a death-rate of only twenty per thousand, and many an English town of 30,000 inhabitants, to a death-rate of only sixteen to eighteen, it will not do for us to claim that Hudson county, with an average death-rate for the whole county of 26.58, and Newark, with a death-rate of 25.49, are in a good sanitary condition. The fact is still more significant when it is remembered how largely the cities are depopulated during the summer, and how many of the deaths that occur are of that zymotic class which largely depends on local evils. No section of country within one hundred miles of New York city has more natural or business attractions than our own State. But if there is neglect of sanitary care, and especially of good water-supply, it is too late to adopt the policy of concealment,

or to point to a death-rate of, say, from twenty-six to thirty as a justification. Such a sustained death-rate in healthy times points to a fearful death-rate if pestilence broods over such nests. Besides, there are evils of sickness, of invalidity, of debility, of depression of vigor, that do not always express themselves decidedly in an increasing death-rate. Where the vigor of population is in anywise impaired, and the marriage-rate and birth-rate decreased, these, as well as the death-rate, are indices of burdens upon prosperity and upon labor, of which those resulting from avoidable disease are the most pressing. It is most noticeable how, in the larger cities of Great Britain, their merchant-princes and their great manufacturers point with pride to the water-supply. If Liverpool has its difficult health problems, it shows a delightful source of water-supply from the hills beyond. If Glasgow has a foul Clyde, it tells you that its people drink only the water of Loch Katrine, stored and filtered amid the great hills of Scotland. London, with its various water companies, is constantly on the alert as to the purity of supply, and by most extended filtering works largely makes up for deficiencies which would otherwise not be tolerated. As our risks from impure water are even more than those from ordinary impure air, it behooves our cities more and more to guard against any contamination of potable water. In the various reports of the State Geologist, and of this Board, as well as in that of the Commissioners of State Water Supply, are to be found valuable facts as to real conditions and as to available sources of water-supply. The great error in some localities has been a too hasty commitment of city interests to some incorporated company. Some of these are excellent and quickly respond to public demand when the water becomes insufficient in quantity or inferior in quality. Others, having become established and profitable investments, resist any popular outcry that requires expense, or very slowly respond to just complaints. A committee at Asbury Park, in a comparison of water-rates in places where the water has been introduced through works owned by the borough or city, found that the rates were over thirty-three per cent. in favor of consumers, as compared with those of incorporated private companies. In other instances, cities have too hastily chosen sources of water-supply on the judgment of non-expert committees, or of engineers little versed in this line of inquiry. The conditions of an efficient water-supply are now so well understood, and the resources of our State in these directions are so good, that no more blunders should occur. We must still urge upon the counties of Passaic, Essex, Union and Hudson the advisability of considering modes of a combined water-supply for the over 500,000 people they contain, and in view of the prospects of a rapidly-increasing population."

We should all along have referred to the annual reports of the Board of Public Works of Jersey City, were it not that the refer-

ences already made include these, since in 1881 a Joint Inspection Board with Newark had been formed, and it contains often the same reports as are included in the Aqueduct Board. The organization was effected October 27th, 1881, and so sanguine were the members that on December 31st of the same year, the Chief Engineer of Jersey City says: "Their work has shown very satisfactory results, and I fully believe that if the methods they have adopted be faithfully carried out, the river will, in a few years, have returned to its original state of purity, and that both Jersey City and Newark will have the best, purest and most abundant source of water-supply of any city within 500 miles of us."

The reports made show that as a rule the supply from the Jersey City in-take was inferior to that from the Newark in-take, which was claimed to be owing to the greater supply to it of Newark sewage by the inflowing tide.

The report of the Aqueduct Board for 1885 notices the fact that the subject of a new water-supply is being agitated, but says, The Board has taken no action in the matter, as the initiatory steps should be taken by the citizens and taxpayers. During the year Prof. Leeds secured samples as before, representing the Newark and Jersey City supplies, and such as were needed for comparisons. This report gives the technical details without comments as to increasing purity. The only additional fact of special import here is that of presenting "percentages of oxygen, as indicating by their relative deficiency the amount of oxygen which has been used up in the course of oxidizing the organic impurities present. For example, the water taken from the Newark reservoir, at Chatham street, July 6th, contained only 3.17 cubic centimetres of oxygen per litre. The carbon dioxide (carbonic acid) had increased to the enormous amount of 4.77 cubic centimetres, and even with this great increase of the gaseous products of oxygen the total volume of gases in solution was only 19.81 cubic centimetres." This not only showed the immense sewage pollution, and the activity of effort on the part of natural chemical processes, but their too great failure, and that with this there was the most urgent need for additional purification. It was this that led Prof. Leeds still further to urge the process of artificial aëration under pressure and apparatus therefor, as named in a former report. He thus proposed to supply the normal percentage of oxygen. This report is especially interesting from the fact that its urgent proposal

is a yielding of the hope of securing purity by prevention of pollution from sewers or factories or from the upper stream and the incoming tides. While, of course, not abandoning these as co-operative, the urgency of this system of artificial aëration is the proof that all these other methods would still furnish Newark and Jersey City with a water-supply so below a proper standard as to require this mechanical restoration, and without which it was too polluted for drinking purposes. During this year the State Geological and Health Reports continued to urge the need of more attention to water-supplies, Boards of Trade discussed the subject, and the newspapers abounded with facts and opinions. No evidence, however, was found to show that the Passaic had become a reliable source of drinking-water. Instead of this, the pollution was increasing. Our next source of expert information is that derived from the reports of Prof. Peter T. Austen and Prof. F. A. Wilbur, covering most of the year 1886 but not rendered until May, 1887.

An additional report was made by the same chemists December 31st, 1887. As they are not accessible like the former reports heretofore alluded to, never having been printed by "The Joint Board on the Pollution of the Passaic River," we give them in full:

REPORT ON THE POLLUTION OF THE PASSAIC RIVER AND ITS TRIBUTARIES.

BY PETER T. AUSTEN, PH.D., F.C.S., AND FRANCIS A. WILBUR, M.S.

RUTGERS COLLEGE,
(NEW JERSEY SCIENTIFIC SCHOOL),
NEW BRUNSWICK, N. J., May 31st, 1887.

To the Honorable the Joint Board on the Pollution of the Passaic River:

GENTLEMEN—We submit herewith our report as chemists to the Board on Pollution, from the date of our appointment to May 31st, 1887.

Collection of Samples.

At the beginning of each month, four samples of Passaic water were collected as follows: one from the Newark in-take, one from the office of the Newark Aqueduct Board, one from the Jersey City

in-take and one from the office of the Board of Public Works, at Jersey City. The samples were collected and forwarded to us, according to our instructions, by Inspector Thomas A. Leake.

Analytical Determinations.

The analytical determinations usually made in drinking-water are as follows: suspended matter, total solids, chlorides, free ammonia, albuminoid ammonia, nitrates, nitrites, oxygen required to oxidize organic matter, and dissolved gases.

We shall explain briefly the meaning of these determinations. It is, of course, not possible in so limited a space to elucidate many of the refinements of water analysis, or even to draw attention to the many inferences that may be made from the analytical results. Such a report would soon expand into a treatise on water analysis, and would be manifestly unadapted to what is here required.

Suspended Matter.

The turbidity of a water is owing, as a rule, to the presence of fine particles of solid matters in suspension—that is, not dissolved, but swimming about in the water. This suspended matter may be clay, mud, finely-comminuted parts of leaves or other debris, or, indeed, of ground-up remains of any substances which are insoluble in the water and which, by any means, may be carried into it. Often these particles are of a remarkable degree of fineness, in which case the water may take several months to settle clear. This suspended matter, as a rule, is not deleterious, except in so far as it makes the water offensive to the sense of sight. What influence clay, mud and other suspended matter may have on the human system it is not easy to say, but there is no doubt that the presence of a turbidity makes the water offensive to the eye. It may be stated, once for all, that water is drunk because it is water, and that the presence of all extraneous matter, except dissolved gases, which make it more palatable, is unnecessary and, so far as possible, to be avoided. The purer a water is, not only as to organic matter, but also as to inorganic matter, the better adapted is it for drinking.

Total Solids.

This determination shows the entire amount of solid matter obtained by evaporating to dryness a known volume of the filtered water. It is usually expressed in grains per gallon. No fixed limits can be given, as waters vary greatly. It is now thought that the less solids a water contains in solution the better adapted it is for drinking purposes. The total solids should be as low as possible. The following statement of Prof. Charles Mayr expresses the latest opinion on the matter:

"Those who have never drunk pure water do not realize what an effect such water has upon the kidneys; its effect is better than that of acetates, nitrates, opiates or alcohol, and for people with tendency to kidney diseases or dropsy there is no better drug than pure water. Of the thousands of chemical compounds and waste products found in the human system many require pure water for their solution and elimination; and water so overloaded with salts as average well-water will not work satisfactorily."

Chlorides.

All sewage, particularly urine, contains a large amount of sodium chloride (common salt), and therefore water which is contaminated by sewage will have an undue amount of chlorides present. This determination has great value in showing the probable presence or absence of sewage contaminations in cases where the influx of tide-water is not to be feared, or where there is not known to be a large amount of chlorides in the soil.

Albuminoid Ammonia.

Experimental science has established the fact that a large number of diseases are communicated from one person to another by means of minute organisms known as microbes, bacteria, bacilli, micrococci, &c., or, more popularly, as germs. The exact description of these minute organisms, as well as an explanation of their modes of development and reproduction, formation of spores, &c., interesting and important as they are, would carry us beyond the limits of this report. The various parts of the human organism afford these seeds of disease a fertile spot in which to take up their abode and grow. The diseased state of a patient is, then, in many cases merely the functional dis-

orders arising from the presence and development of certain other forms of life at his expense. These disturbances may arise from the mechanical irritation resulting from the presence of the organisms, and also from the poisonous action of the substances produced by their growth, their excreta, if the term is permissible. It is a struggle for existence, a survival of the ones best adapted to the conditions about them. If the patient dies the disease organisms are triumphant, if he recovers they are vanquished. In many cases it is a bitter fight and a long time may elapse before one can tell which will win.

To consider the details of this subject would lead us far away from the matter in hand, for we wish to simply explain the relations of disease to water-supply. The communicability of disease, as in cases of small-pox, scarlet fever, diphtheria, &c., is well understood by the public. The germs of these diseases come in contact with the proper membranes and proceed at once to develop and cause the specific functional disturbances known as the diseases. We have good evidence to show that diseases can also be communicated by water, if the water contain their germs. These germs, like all forms of organisms, require nutriment for their growth and development, and their most necessary food is albuminous matter.

When the remains of animal and plant life, excreta and many manufacturing wastes are allowed to remain in water it becomes polluted by substances which belong to the classes of albumens and gelatines, and which, for the sake of convenience, are called albuminoid matter. These substances are distinguished by the ease with which they decompose or putrefy, producing in so doing ammonia, nitrites, nitrates and nitrogenous organic substances, depending on the nature, extent and duration of the decomposition. These albuminoid matters constitute the principal food of the myriads of germs which exist in water, and which will grow and reproduce with almost inconceivable rapidity, if provided with a sufficient quantity of nutriment. Some of these minute forms of life (bacteria, bacilli, micrococci, &c.), as has been explained, are disease germs (pathogenic microbes), while others have no harmful effect, so far as we know, upon the drinkers of the water.

There are myriads of these harmless microbes which act as scavengers, and consume the albuminoid matters in water, thus purifying it. It is to their work that we are indebted for much of the self-purification of water.

These disease germs and nitrogenous organic substances may cause disease in persons drinking the water containing them. In themselves, the albuminoid matters may not be poisonous, or even deleterious, as they are, without doubt, digested as any other similar matters. But their presence in any considerable amount renders the water capable of supporting germ-life, and hence it requires but the impregnation with the proper disease-germs to become in an extremely short space of time filled with countless swarms of these organisms, and thus be in a condition to convey and impart diseases with frightful efficacy. A polluted water may, then, so far as its relations to germ-life are concerned, resemble a powder-magazine, not unsafe until a spark happens to fall into it. Thus, in the town of Plymouth, Pa., the water of the reservoir, which was not in a good condition as to freedom from organic impurity, became impregnated by the excreta of a typhoid patient, and hundreds of cases of typhoid developed among those who drank the water. A similar case occurred on a smaller scale in the village of Lausanne, in Switzerland, the water-supply becoming impregnated by the dejecta of a typhoid patient and imparting the disease to many persons who drank the water. Numerous cases of a similar nature could be cited as to the danger from contaminated wells. In fact, it is safe to say that, as a rule, all wells in cities are unsafe, or at least should never be used for potable purposes until proved safe by the most searching analysis. On the other hand, if a water is free from germ-life nutriment, any germs that may get into it, will find it difficult to thrive, and will be more liable to be destroyed by the numerous agencies that are continually exerted to effect their destruction.

The nitrogenous organic substances which result from the putrefaction and decomposition of albuminoid substances are often extremely poisonous. Many of these substances belong to the class of alkaloids known as "ptomaines," or cadaveric alkaloids, the name being given more particularly to certain substances which are formed during the putrefaction of dead bodies. Some of these ptomaines are found in the excreta, and are the normal results of life. Others are produced as a result of disease. These substances, when present in water, may produce bowel-troubles and other functional disorders, if not specific diseases, in those who drink the water. Thus, substances have been obtained by the distillation of city well-waters that produced severe bowel complaints. A great number of cases could be cited in which

the introduction of sewage into drinking-water has caused disease. The liquid in which the cholera bacillus has been found contains a poison which, when properly applied, produced a disorder which is, or greatly resembles, cholera. The discovery of the alkaloid formed in stale milk, tyrotoxicon (though now thought to be diazobenzene), shows the probable cause of the prevalence of cholera infantum and "summer complaint."

There are numerous fresh-water plants, as algæ, sponges, lilies, &c., as well as parts of land plants, leaves, buds, &c., which, when putrefying in water, may increase the albuminoid ammonia, and thus cause the water to assume a dangerous receptivity for disease germs, aside from any specifically deleterious action that the products of the decomposition may themselves exert. The death and decay of myriads of animalculæ and microscopic eggs may produce a decided increase in the amount of albuminoid matter.

The determination known as "albuminoid ammonia" represents the amount of ammonia that can be obtained from the albuminoid matters present in the water. It depends upon the fact that albuminoid substances, when heated with an alkaline solution of potassium permanganate, are decomposed and give off nitrogen as ammonia. As a general rule, chemists consider that the less albuminoid ammonia a water contains the better is the water. The presence of 0.10 parts of albuminoid ammonia per million is looked upon as a very suspicious sign, and when the amount reaches 0.15 parts per million, it is usual to condemn the water, especially if the nitrates and nitrites are present, indicating that fermentation is, or has been, active.

Free Ammonia.

Free ammonia is ammonia existing already formed in the water. It may be free, or combined as ammonia salts. When unaccompanied by any considerable amount of albuminoid ammonia, free ammonia indicates the presence of some manufacturing waste or recent addition of rain, snow, &c., or inorganic substances containing ammonia salts, and is of no particular importance. When accompanied by albuminoid ammonia, it indicates that some of the albuminoid ammonia has decomposed, and the water must then be examined with care. When accompanied by albuminoid ammonia and high chlorides, it indicates pollution by urine.

Nitrites and Nitrates.

When albuminoid matters are oxidized they form nitrites, and when further oxidized, the nitrites pass into nitrates. Certain minute organisms have also the power to reduce nitrates back to nitrites and ammonia. If albuminoid matters are absent, nitrates and nitrites indicate that the organic matters have all been oxidized. Their presence may or may not be of importance, depending on the location and source of the water and upon the nature and amounts of the other constituents. As a rule nitrites are supposed to indicate that the oxidation of the organic matter is imperfect and recent. Their presence is, therefore, a danger signal. When nitrates or nitrites are detected in any quantity a searching examination should always be made, not alone of the water, but of its source and surroundings.

Hardness.

Water containing salts of lime and magnesia does not at first yield a lather with soap, but "kills" the soap. Such water is called "hard." If the lime and magnesia are present in the form of carbonates, they are thrown down when the water is boiled, since the carbonic acid gas which, when dissolved in the water, imparts to it the property to dissolve the carbonates of lime and magnesia, is driven off by the boiling. The dissolving agent being thus removed, the carbonates of lime and magnesia precipitate, and the water is rendered softer. Advantage is taken of this in the preliminary heating of water before its introduction into steam boilers. Hardness which is removed by boiling is called "temporary" hardness. If the hardness consists of sulphates or chlorides of lime and magnesia or of any other salts or substances which kill soap and are not removed by boiling, the hardness is called "permanent."

Hardness is usually expressed by stating the number of grains per gallon of carbonate of lime (chalk) or substances equivalent in soap-killing power, that are contained in a gallon of the water. The effect of the hardness of water in increasing the cost of using it may be best estimated by calculating that each degree of hardness causes the "destruction of twelve pounds of the best hard soap by every 10,000 gallons of water."

The effect of a considerable amount of lime and magnesia salts on

the human system is not constant, since entirely opposite effects are produced in different people. Some medical writers catalogue a long list of ailments as caused by the use of hard waters. There seems, however, to be no doubt but that the solvent action of water and its power to remove the wastes of the human organism increase with its freedom from mineral substances in solution. Hence the less the hardness, the better adapted will it be for drink. As before stated, the opinion is growing now very rapidly that water is drank for the sake of the water in it, and not for anything else. Modern scientific investigation indicates that in proportion as the amount of pure water supplied to a community increases, there is corresponding, but far greater, decrease in the death-rate, the disease factor and the cost of living and manufacturing. While with the increase in the supply of pure water increases also in a most surprisingly rapid manner, the thrift, morality and degree of civilization. The amount of water used per head by the inhabitants of a community is a very fair index of its state of civilization. It is a matter of regret that so much timidity is evinced in dealing with questions of water-supply. There are many thousands of deaths in cities that might be prevented by an improvement in the quality of the water. The death-rate of the United States at present is estimated to be over 100,000 per year too high.

Oxygen Required to Oxidize Organic Matter.

This determination indicates relatively the amount of very easily oxidizable organic matter present in a water. Alone, it does not possess a very definite interpretation, but in conjunction with the other determinations, it is of value in forming an opinion as to the conditions of the water. In time, it may be possible to give determination a greater importance, especially if, in any way by its use, we shall become able to tell the difference between living and dead organic matter.

Dissolved Gases.

All natural waters dissolve from the air certain amounts of oxygen and nitrogen gases. If the water is perfectly free from organic matter the ratio of dissolved gases would not alter very much, but if organic matter is present, more or less of the oxygen is consumed in oxidizing and destroying it. This consumption of oxygen may be

direct, or it may be brought about through the agency of minute organisms which require oxygen for their existence and which in turn feed upon the organic matter. The nitrogen which is dissolved in the water does not suffer much change, but the oxygen, from the causes just explained, fluctuates to a marked extent. As one of the principal products of the exidation of organic matter is carbonic acid, water in which organic matter has suffered oxidation usually shows an increased amount of dissolved carbonic acid gas and a decreased amount of dissolved oxygen. A water may, therefore, be bright and sparkling and still be anything but pure. The higher the content of dissolved oxygen and lower that of dissolved carbonic acid gas the better water is to be considered.

Color.

The opinion of chemists concerning the conditions indicated by the color of a water are well expressed by Dr. Fox as follows:

"It is helpful in forming an opinion as to the quality of a water to pay a certain regard to its color, although apart from other indications of its conditions, no reliance should be placed on this test. Speaking generally, it may be said that waters of great purity exhibit a bluish hue, that waters polluted by filth have various shades of a straw or brownish tint, deeper in proportion to the amount which they contain, whilst peaty waters generally display a nutty-brown color. To this rule there are many exceptions. A water may possess a strong brown or yellowish tint and yet be free from filth, *e. g.* some peaty waters, and waters containing iron. Certain artesian waters of great purity have a straw tint. The Loch Katrine water, which supplies the city of Glasgow, displays a color apparent to every one. On the other hand, some waters that are as devoid of color as distilled water, and exhibit great brilliancy, are found to be polluted with a large amount of animal filth. A water may be almost colorless and yet exhibit on analysis much vegetable matter, *e. g.* the water-supply of Bournemouth. A water may be colorless and still contain peat, for white peat is occasionally met with which is a form of incompletely carbonized vegetable matter. Practically, however, peaty waters present various shades of a brownish olive-green color, if the peaty matter is in larger quantity, through a nutty-brown to a coffee color, when the peat is old and abundant." And again: "Thousands are still to be found who believe that if a water is bright and clear, and not unpleasant to the taste, it must be good, whilst it has been proved over and over again that such a water may be polluted with unspeakable filth, and that an excessive brilliancy of a water is a suspicious sign."

Analyses of the Passaic Water.

The accompanying table (1) shows the results of our analyses of the samples of Passaic water sent us.

[NOTE.—Table not printed but results here given.—SEC'Y.]

Many interesting deductions can be made from these figures. We shall, however, mention only a few of the more practically important ones. The total solids show a steady decrease from October to May. The reason of this is that the volume of water in the Passaic increases steadily during this period. In April the total solids in Jersey City ran 2.5 grains per gallon; in Newark 3.4 grains per gallon. In this respect the water was very satisfactory. The volume in the river is on the decrease from April through the summer, and hence from that date till fall, a steady increase in the amount of total solids is to be expected. If the summer is a dry one, the amount will reach a high figure, because the waste and sewage, if anything, increase, while the volume of the river greatly decreases.

The same may be said for the hardness, the increase and decrease following quite closely the curve of the total solids.

The determination of the chlorides is of little value in the case of the Passaic water, as chlorides can come from tide-water and manufacturing wastes as well as from sewage.

In June the albuminoid ammonia in the water of Newark, and in February the water of both Newark and Jersey City fell below 0.15 parts per million, which is regarded as the beginning of the danger limit. At all other times the amount of albuminoid ammonia has been above this amount, the highest figure, so far, being reached by the Jersey City water in December. This amount, 0.3 per million, if occurring in a well-water, would have condemned it at once. Should a sample of water submitted to us for analysis by a Board of Health have given us this amount we should have reported it as absolutely unfit for use and dangerous in the extreme.

The continual presence of nitrites in the water, with the exception of the month of February, shows that oxidation of the organic matter is taking place. The amount of dissolved oxygen was higher in winter, as the organic matter is not so easily oxidized as in the summer. As the amount of dissolved oxygen decreased in the summer, the amount of dissolved carbonic acid, which results from the oxidation of the organic matter, will increase.

Our opinion, based upon the mass of analytical data herewith presented, is, that during the greater part of the year the water of the Passaic, which is used to supply the reservoirs of Newark and Jersey City, and which is supplied to the inhabitants of those cities, is contaminated by filth, sewage and manufacturing waste and is unfit for drinking purposes. In the summer the water reaches a degree of pollution which makes its use dangerous beyond a doubt. Should the water during these months become impregnated with the seeds of typhoid, cholera or other zymotic diseases, the most disastrous results may be expected.

We have no doubt that the use of a purer water in the cities of Newark and Jersey City would be attended by a most marked decrease in the death-rate, especially that of children.

Pollutions of the Passaic.

Acting under the instruction of the Board of Pollution, samples of a number of the manufacturing wastes which are discharged into the Passaic were collected by Inspector Leake and submitted to us for analysis. Before expressing our opinion on these samples we wish to explain* the more important principles which are involved in the pollution of water, and also the meaning of certain words often used in this connection.

In an act approved February 27th, 1883, and quoted in the circular issued by the Joint Board on Pollution of the Passaic River and its Tributaries, it is made a criminal offense to throw, or cause to be thrown, or permit to be thrown into the waters of any creek, pond or brook of this State, the waters of which are used to supply any aqueduct or reservoir for distribution for public use, any offensive matter whatever calculated to render said waters impure.

To avoid repetition in the consideration of each sample of water it will be best to draw attention to certain important properties which a water should possess to render it acceptable for drinking, household and manufacturing purposes, and conversely to certain properties which will render it unfit for uses for which the water-supply of a city is intended.

For drinking purposes a water should be clear, that is, free from all suspended matter, such as clay, mud, fragments of leaves, sedi-

*A portion of this report on the pollution of the Passaic was made to the Joint Board on Pollution, during *the fall of 1886.*

mentary matter, &c. Even though such matter be not in itself poisonous, or even to any extent appreciably detrimental to health, it will still be offensive to the eye, and the presence of such impurities will detract from the enjoyment attendant on its use. So, also, in the bath, the water should appear pellucid and inviting, and any matter which in any way prevents it from being so is offensive.

The water should contain a sufficiency of dissolved gases, especially oxygen gas. A water not containing sufficient dissolved gases will taste flat, and thus be offensive to the sense of taste.

The water should be free from any marked taste other than the agreeable sensation imparted by a pure and sparkling water. Any taste that a water may possess will offend the sense of taste and will render the water unpalatable to many people.

The water should be free from any color, which, although such coloration may in certain cases be not deemed detrimental to health, is most certainly offensive to the eye, and will excite a feeling of repulsion rather than of agreeable expectation. Such a coloration also causes in the minds of many persons, especially among the uneducated, feelings of alarm as to the safety of the water.

The water should be free from any odor, since the presence of a recognizable odor offends the sense of smell as well as at once awakens feelings of alarm among the people. Nor should it, on standing, develop any unpleasant odor, since it will then also become offensive.

The water should be as free as possible from mineral matter, since its presence in any considerable amount may cause the water to produce certain specific physiological effects and thus render it offensive to the public health. Organic matter in any amount should also be absent, since it may, aside from exerting any physiological effects, afford nutriment and means of development for numerous species of lower organisms, both vegetable and animal, many of which, such, for instance, as the pathological bacteria, or disease germs, may cause the water to become the means of spreading disease and thus endanger the public health and increase the death-rate.

Any substance which, when added to a drinking-water, causes the water to offend the senses of sight, smell or taste, or which makes the water unhealthy or dangerous to drink, is offensive matter, and will render the water less pure, or impure.

In relation to the uses of water for household purposes, the addition to the water intended for these purposes, washing, the preparation of food, &c., [of any thing] which in any way is detrimental to its adapt-

ability to these uses, is offensive matter and will make the water impure. Not alone will it render the water impure, but it may, in case the hardness is increased, cause an increase in the expenses of housekeeping, as, for instance, in the increased use of soap, which will be brought about by an increase in the hardness.

Again, the addition of any matter which may increase the hardness of the water, or which may increase the amount of total dissolved solids, will cause the water to form scale in boilers more rapidly, and thus not only compel a greater use of fuel by those who use steam, but will also shorten the lives of the boilers, thus adding to the cost, and will also increase the dangers attendant on their use. Any substances which, when added to a water, will render it less adapted for use in steam boilers, is an offensive substance.

Further, any substance which, when added to a water, renders it less adapted for use in the household or in manufacturing, will increase the cost of living or manufacturing in the cases of some or many of the inhabitants of the city, and thus to a lesser or greater extent will eventually injure the prosperity of the town by decreasing the amount of capital available for enterprise or investment. Any matter in any way causing or bringing about these results we may consider offensive.

It is also to be noted as a fact that must not be overlooked that the water of the Passaic which is used in Newark and Jersey City is judged by certain forms of chemical analysis. It is hence evident that any matter which, when present in the water-supply, is condemned by the analysis, must also be condemned if found present in the water entering the Passaic, and that wastes, &c., containing constituents which will cause the water-supply to be adjudged impure must be condemned as offensive.

The question may arise as to how to deal with waste waters discharged into the Passaic, which, while not so pure as the river water, are still not so impure in any individual case as to excite apprehension. If only one such case occurred no great danger might be feared, but when a number of such waters enter the river, the effect of them all will become very appreciable. In this case strict impartiality is the only safeguard, and the total evil should be abolished by abolishing each and every cause of it. No matter of any kind should be allowed to enter the Passaic within the limits prescribed by law, which in any way renders the water less adapted for potable, house-

hold and manufacturing purposes by the inhabitants of Newark and Jersey City.

In accordance with the views above set forth we express our opinions on the samples submitted to us for examination as follows: (Table 2.)

[NOTE.—Not printed herewith, but results as stated by the chemists herewith given.—SEC'Y.]

No. 1. (C1023) Condemned on account of high total solids, high hardness and high albuminoid ammonia.

No. 2. (C1024) Condemned on account of high albuminoid ammonia. Inspection showed the water to be polluted by privy drainage. On standing, acquired an offensive odor.

No. 3. (C1025) Condemned on account of high total solids and high albuminoid ammonia. On standing, acquired an offensive odor.

No. 4. (C1026) Condemned on account of high hardness and high albuminoid ammonia. On standing, acquired an offensive odor.

No. 5. (C1027) Condemned on account of high total solids, high hardness, high albuminoid ammonia and presence of color.

No. 6. (C1028) Shows the effect of the waste discharging into the creek, in high total solids, high albuminoid ammonia and color.

No. 7. (C1029) Condemned on account of high total solids, high albuminoid ammonia, and the presence of taste, odor and suspended organic matter.

No. 8. (C1030) Condemned on account of high total solids, high albuminoid ammonia, and presence of taste, odor, color and suspended organic matter.

No. 9. (C1031) Condemned on account of high total solids, high albuminoid ammonia, and presence of color, taste, and organic matter in suspension. On standing, acquired an offensive odor.

No. 10. (C1032) Condemned on account of high total solids, high hardness, high albuminoid ammonia and the presence of brick-red suspended matter. On standing, developed an offensive odor of sulphuretted hydrogen.

11. (C1033) Condemned on account of high total solids and high albuminoid ammonia. It has also a perceptible woody taste.

No. 12. (C1034) Not condemned.

No. 13. (C1045) Condemned on account of high total solids, high hardness, high albuminoid ammonia and color. On standing, acquired an offensive odor and condition.

No. 14. (C1046) Condemned on account of high total solids, high hardness, high albuminoid ammonia and color. On standing, acquired an offensive odor and passed into an offensive condition.

No. 15. (C1047) Condemned. A thick, turbid liquid with an excrementitious odor. Appeared to be sewage. The ammonia determinations were made in the liquid after settling.

No. 16. (C1048) Condemned on account of high albuminoid ammonia, high hardness and high total solids.

No. 17. (C1049) Condemned on account of high albuminoid ammonia. When received, possessed an offensive odor and contained decomposing organic matter.

No. 20. (C1052) Condemned on account of high total solids, high hardness, high albuminoid ammonia. On standing, acquired an offensive odor.

No. 24. (C1058) Condemned on account of high total solids, high albuminoid ammonia and high suspended matter.

No. 25. (C1083) Condemned on account of high suspended matter, high albuminoid ammonia. On standing, acquired odor.

No. 26. (C1084) Condemned on account of high total solids, high suspended matter, high albuminoid ammonia and color. On standing, acquired an offensive odor.

No. 27. (C1085) Condemned on account of high total solids, high albuminoid ammonia and color. On standing, acquired an offensive odor.

No. 28. (C1086) Condemned on account of high total albuminoid ammonia and color. On standing, acquired an offensive odor.

No. 29. (C1087) Condemned on account of high albuminoid ammonia, high hardness, high total solids and large amount of matter in suspension. On standing, acquired an offensive odor.

No. 31. (C1089) High total solids, otherwise not objectionable.

No. 38. (C1120) Condemned on account of high albuminoid ammonia, high total solids and turbidity.

No. —. (C1138) Condemned on account of high total solids, high albuminoid ammonia, suspended matter and color. On standing, acquired an offensive odor.

In addition to the great quantities of manufacturing wastes that are emptied into the Passaic above the in-takes, and which pollute the water, another serious source of filth is introduced by the sewage of Newark and the manufacturing wastes which are emptied into the

Passaic below the in-take, and which may at times be carried up to and beyond the in-takes by the tides. How far up the contamination of the Passaic by the Newark sewage extends, we have not yet determined with exactness, but there is every reason to believe that at times it exerts a very decided polluting effect on the waters supplied to Newark and Jersey City.

If, as it has been recently stated, the Jersey City water contains more Newark sewage than the Newark water, it is not clear why the Jersey City water does not run higher in chlorides than the Newark water. But pronounced differences such as might be expected have not yet been detected.

An analysis of the sewage from the Fourth avenue sewer is appended to show the nature of typical sewage.

No. 30. (C1088) Table 2.

[NOTE.—Table not printed.—SEC'Y.]

(II.)

REPORT ON THE POLLUTION OF THE PASSAIC RIVER.

BY PETER T. AUSTEN, PH.D., F.C.S., AND FRANCIS A. WILBUR, M.S.

RUTGERS COLLEGE,
(NEW JERSEY STATE SCIENTIFIC SCHOOL),
December 31st, 1887.

To the Honorable the Joint Board on the Pollution of the Passaic River:

GENTLEMEN—We submit herewith our report as chemists to the Board on Pollution from June 1st to December 31st, 1887. (Table 3).

[NOTE.—The chemists thus state its result.—SEC'Y.]

The samples have been collected and analyzed as described in our first report. The water supplied to Newark and Jersey City during the months of June, July, August, September, October, November and December has been steadily bad. In July it was extremely filthy. It was hoped that the condition of the water would improve during November and December, as an improvement was noticeable in October, but the hope was not fulfilled, and the water became worse instead of better. The condition of the water does not vary very much. As stated in our first report, it is filthy from the great amount of impurities poured into it. It shows a slow but still perceptibly steady increase of pollution. We can only reiterate our condemnation

of the water for drinking purposes. It is utterly unfit for use, and no time should be lost in procuring a purer supply. There is no doubt but that the introduction of a pure water-supply into the cities of Newark and Jersey City will be marked by a decrease in the death-rate.

[NOTE.—Thus ends the last report.—SEC'Y.]

It will be noticed that the chemical analyses and the language of both these reports are more and more decided against these waters as a source of drinking-supply.

The report as rendered December 31st, 1887, is of the most pronounced character and cannot be read with placid unconcern by any one who regards the preservation of human life as a personal and general concern. The supplies for both cities are so bad that the chemists do not seek, as before, to rate their relative unfitness. During this same year, a number of the citizens of Jersey City, in their own interest and that of their locality, sought again the opinion of Prof. Leeds. This was given in reply to a series of questions now published in pamphlet form. The answers thereto recount the sources of pollution of the Passaic river under seven heads, and show their continued increase, and that the water flowing into the in-take of the Jersey City pumping station each day, contains a great weight of sewage. In reply to the question, Is the water at present supplied to Newark and Jersey City, dangerous to health? he begins by saying: "This is as though I were asked, Is drinking sewage dangerous to health? I believe it to be not merely dangerous, but so fatal that thousands of people are killed by sewage-drinking every year." Of this he gives various illustrations from authorities. He adds: "Nor is its virulence restricted to the production of typhoid fever only, for typho-malarial and other zymotic diseases frequently have the same origin. During a greater part of the year much of that general malaise and debility which large numbers of people suffer from is partly attributable to the cumulative action of the sewage-polluted drinking-water upon their systems."

Does it not seem that thus we have an amount of competent testimony extending through series of years, resulting from hundreds of analyses of different years and different seasons and by numbers of competent chemists, all agreeing as to the hazardous character of this water and as to its increasing befoulment?

During the present year, this Board saw fit also to cause a new series of chemical examinations to be made, with the primal object,

however, of associating them with *bacteriological* examinations, so as to see how far these fortified or disputed the conclusions arrived at by physical and chemical examinations.

This additional examination, so far as its bacteriological addition is concerned, is made with the admission that the distinction between the pathogenic and conservative or microphytic life is not so accurately made out as to enable us to determine the full significance of numbers. But as it is conceded by many that the quantity of bacteria has relation to the quantity of decaying and putrescent organic matter present, it was thought proper to secure such an analysis. The chemical and biological examinations, as made by Prof. Leeds and as given in the report (see pages 151–6), are in the direction of confirming former examinations, and show the large amount of this minute life at places where pollution is shown by the chemical examinations.

In view of all the evidence which we have thus presented we submit that by all the methods available in physical and expert examination and testimony, the Passaic water, as at present delivered to Newark and Jersey City, is too much mingled with sewage for its use as a public water-supply to be approved or defended.

Those, however, who are disposed fairly to consider the matter and to give weight to the opinions of those who are believed to have arrived at sound conclusions, ask such questions as these: If all this is true why do not more people sicken and die? Why are not physicians more fully agreed as to the dangerous effects? These are allied and proper questions, and may as well be met together.

First of all, it is not true that poor water records all its effects in perceptible ill-health. Here are some of the reasons why it does not:

Such water is not at all times equally impure. By reason of abundant rains the dilution often varies in the Passaic in proportions of one to six, so that from this alone there is great variation in the quantity of organic matter contained. It also varies from the character of the sewage, from difference in suspension or solution, and from difference of humidity and temperature. Our study of the chemical statements shows that sometimes in one month it could be pronounced "drinkable," and in another month "lamentably polluted," and from causes beyond local control. Susceptibility of persons also varies.

Hence, there would necessarily be great variation in effects even if these could be discerned. But all that any one is called upon to show is that the conditions are those of great liability and that there is a hazard unsafe to health or life.

Again, when there are real effects the systems of most persons are so far resistful as that no immediate effects or no effects that can be by any method of exclusion asserted, are recorded. So long as there is not such a specific result as typhoid fever or dysentery, or malarial fever, or prostrating diarrhœa, there may be multitudes of minor and depressing results without the possibility of record. That such results do occur is the common consensus of opinion of practitioners who have closely studied localities afflicted with a very poor water-supply or those who have been able to compare the conditions in the same city when it had a poor supply and afterward a good one.

We have already referred to the fact that physicians do not have it in their power in most cases to discern all the influences that have been in operation to cause many diseases. Yet it has been our experience that those physicians who are careful observers and have given their careful judgments all recognize that water which by the usual tests is found to be quite uniformly impure is not fit for a public water-supply, because of its results in the impairment of individual health. We have had occasion to find that physicians are often misquoted and that some passing remark comes to be assumed as a settled conviction.

But is it not true that we have reason to believe that the water used in Newark and Jersey City has had an effect greatly to add to death and sickness-rates? When we compare with the average death-rate of the State for the past nine years, we find an excess in Newark and Jersey City of such a proportion to each thousand of inhabitants, as means the loss of hundreds of lives. Besides, in this we are comparing in the aggregate with a general death-rate which is in itself higher in some localities, probably because of conditions of water-supply similar to these cities. No one claims that there should be a death-rate anywhere in this State of over fifteen per thousand, and theoretical calculations even reduce the normal rate to twelve per thousand.

Our first five years of death record, from July 1st, 1878, to July 1st, 1883, gave a total death-rate for the State of 19.43 per 1,000, that for Jersey City being 24.27 and that for Newark, 23.52, these being the two highest death-rates in the State.

When we come to inquire as to deaths of children and deaths from typhoid fever and from diarrhœal diseases, under two years of age, we find 6,625 children under five years of age died in this period in Newark, and 6,636 in Jersey City, or in all, 13,261. Total deaths

at these ages for the State, being 27,704. In other words, these two cities with their 257,230 inhabitants had nearly one-half as many deaths at these ages as the rest of the State had with its 873,887 inhabitants. Is not that an arousing fact? It is also to be borne in mind that even at this we are comparing with a State record which includes parts of Hudson county, Camden and a few other considerable populations also known to have a poor water-supply. A proper comparison would be with other populous cities having a good water-supply, if we had enough of such large cities.

These two cities, with a little over one-fifth of the population of the State, lost from typhoid fever, 361+374=735 out of the 2,818, and from diarrhœal diseases, under twenty, 1,774+1,574=3,348 out of 11,768. There is here very marked excess of proportion. Since digestive and intestinal diseases of adults, and consumption and other diseases are greatly affected by a poor water-supply, it would be fair also, if we knew the proportion, to attribute the large excess in these diseases, to some degree, to poor water. But the figures already presented are enough to show that something very evenly and persistently secures to these cities a very high death-rate of these ages and from these diseases, such as would put the water-supply under suspicion more than any one known operating cause.

We now turn to the record for the past five years, viz., from July 1st, 1883, to July 1st, 1887.

For the first of these years we have as follows: Total death-rate for the State, 19.20 per 1,000. For all cities over 5,000 inhabitants 23.59; the death-rate of Jersey City being 25.15 and that of Newark 24.70. In this comparison Atlantic City should be counted out, because its own statistics show that its high death-rate is entirely owing to infants brought there, that soon die in the summer. Paterson, also, has several operating causes besides water which tend to give it a very high death-rate, and so far as factory influence is concerned, even beyond Jersey City or Newark. So, also, as to Jersey City, it is to be remembered that other parts of Hudson county having a high death-rate and using the same water, increase the significance of the per cent. This more than balances the underestimate of the population which occurs in these two years.

The number of children that died under five years of age was 7,971, of which 1,267+1,339=2,606 who died in these two cities. Here, again, there is much excess, especially when we remember that the compari-

son is made with a total including Camden, Hoboken and Paterson. Newark and Jersey City, representing about one-fifth of the entire population of the State, lost by typhoid fever 116 and 87 respectively, or 203 against 640 for the whole State.

From diarrhœal diseases under twenty years of age we have 425+402=927, out of a total for the State of 2,462.

The statistical year from July 1st, 1884, to July 1st, 1885, is reckoned upon the census of 1885, being 1,278,033 for the State, 153,513 for Jersey City and 152,988 for Newark, or a total of 306,501 for the two cities.

In this year the number of children who died under five years of age in the State was 9,120, of which Jersey City lost 1,542 and Newark 1,543, or a total of 3,085, or nearly one-third of those lost at these ages for the whole State. Here is a noticeable and somewhat remarkable increase of deaths during the year. It is well worthy of note that coincident with it was an unusually unfavorable condition of the water-supply, beginning in February and continuing until October. (See Prof. Leeds' report.)

This year typhoid fever caused 642 deaths in the State, of which Jersey City records 100 and Newark 94, or 194 in all. Of diarrhœal diseases under twenty years of age, the record for the State was 2,845, of which Jersey City had 375 and Newark 443=818.

From July, 1885, to July, 1886, the total death-rate for the State was 17.80 per 1,000, that of Jersey City being 22.02 and that of Newark 23.94. The total city death-rate for that year for the State was 20.63.

The number of children that died under five years of age was 8,537 for the State, of which 1,489 died in Jersey City and 1,448 in Newark, or 2,937 in the two cities. The deaths from typhoid fever for the State were 545, of which Jersey City had 88 and Newark 85, or 173 in all. The deaths from diarrhœal diseases, under twenty, for the State, were 2,664, of which Jersey City had 407 and Newark 369, or 776 in all. The proportions, although not so large, are still quite excessive, as the year was one of unusual health. Alongside of this, examine the deaths from other diseases.

From July, 1886, to July, 1887, the total death-rate for the State was 19.04 per 1,000, that of Jersey City being 24.01 and that of Newark, 24.40. The total city death-rate for the year was 22.24 per 1,000.

The number of children that died in the State, under five years of age, was 9,245, of which 1,636 died in Jersey City and 1,474 in Newark, or 3,110 in both. The deaths from typhoid fever for the State were 522, of which Jersey City had 81 and Newark 84, or 165 in all. The deaths from diarrhœal diseases for the State were 2,694, of which Jersey City had 456 and Newark 446, or 902 in all, being over one-third of the number for the whole State.

No one can take up this series of results for nine years past and add to it the facts as to mortality from adult intestinal diseases, from consumption and from general impairment of vigor and abbreviation of the natural working period of life, without being impressed with the view that there is some pervasive and widely-operating cause that produces an excessive death-rate in those cities, and that this excess is especially manifest in ages and diseases which we would expect to be affected by an imperfect water-supply. We know that the contestant on either side can present points which would increase the significance of these figures, or which would plausibly but not really minimize their significance. But we believe that no one versed in the expert study of physical, chemical and statistical signs, as they bear upon the study of population, or who will, with impartial judgment, review the facts presented, but that will be led to conclude that the water-supply, as derived from Passaic river, is under the gravest suspicion in this record of child-slaughter, and is severely on trial with heavy testimony against it. We do not declare the supply to be worse than that furnished to Philadelphia, Camden and several other cities in this country. But we cannot but present the unanimous conviction of this Board, of various other State Boards, of numerous chemists, physicians and observing civilians, that the drinking-water at present furnished to large populations in Jersey City, Newark and some adjacent towns is not such as meets a public demand; is not such as a State, whose duty it is to conserve the highest health interests of its people, can approve. The figures given are in accord with such belief.

We claim for Hudson county ordinary advantages for health, if only it has or secures health administration and structural provision for its sanitary necessities. We claim for Essex county some of the most inviting advantages of location to be found anywhere. We look upon this portion of New Jersey as fitted for prospective and rapid increase of population to a degree second to no part of this State, or adjoining States, if only there are broad views of the rela-

tions of health to prosperity, and of the duty of recognizing pure water and protection from preventable diseases as, alike, the right of humanity, of labor and of citizenship. There has been wonderful growth in spite of those drawbacks, and there would be far greater if they were removed.

We have purposely avoided the expression of mere opinions. We have not argued the short-sightedness of present methods. We have not, in the presence of the abundant evidence on the subject, thought it necessary to draw attention to any particular sources of supply, or to magnify the easy possibilities of securing a water-supply and storage second to none in this country. But we have thought it timely and imperative upon us to thus review some of the facts in evidence and thus to seek to impress upon the people of these cities, and upon the State, the great demand there is for a better water-supply for sections so close together, and representing nearly half of the whole population of the State. We have only allowed facts to speak for themselves.

The tortuous but noble Passaic reaches some of the most delightful and populous regions of the State. It has other sufficient uses besides those of inundation for the country and sewer-holding water-supply for the towns.

Just now the combined efforts of the managers of the Geological Survey, of the State Board of Health and of local committees seem likely to succeed in such arrangements at Little Falls as will relieve the overflowed lands and add tens of thousands of dollars and numbers of lives to that district. We believe that a more notable increase of values, of health and of life will follow when this river ceases to be used for the conjoint purposes of sewerage and water-supply, and when the hundreds of thousands living near its banks will avail themselves of those provisions which nature has made for a pure, accessible and abundant supply. When that is secured, an impetus will be given to the growth of those cities and the surrounding districts such as will gladden the hearts of the people, for it will not only mean increase of wealth, but increase of health and preservation of life, thus adding to the comfort, industry and happiness of our citizens and conferring a blessing on the whole State.

CLIMATOLOGICAL OBSERVATIONS AND RECORDS.

As heretofore, we present, as far as possible, climatological observations and records from several portions of the State. It will be recalled that these were originally chosen to represent the distinct geological and soil formations of the State, in order that there might be a comparison of diseases with reference to locality. It was not important that the location be continuously at one point, but that it be not so far removed as to cause much variation, and that it be upon the same formation as the one first chosen.

The localities, as designated in the sixth report, 1882, were—

I. Newton, Sussex county, to represent the Kittatinny valley, and the sandstone, slate and adjacent rock.

II. Paterson, to represent some slight variations for the same general district. But the two together stand for the azoic and paleozoic formations of northern New Jersey.

III. Newark represents the eastern part of the red sandstone section.

IV. New Brunswick, Princeton and Trenton represent the more western red sandstone sections.

V. Freehold, while not very far from the same section, amid the sand and clay marls, represents the upper cretaceous formation.

VI. The more recent or tertiary formations of sand or clay and the climate, as varied by its inland position, is well represented by Vineland.

VII. Atlantic City or Cape May, on a similar sandy formation, stands for our more southern Atlantic coast.

VIII. Sandy Hook or Middletown has served to represent the northern Atlantic coast with the mingling of sand and clay marls and its cretaceous formations.

It will be noticed that we have been compelled, from time to time, to change the precise point of record, but not to any disturbing extent.

This year, owing to the lamented death of Miss E. Foster, the excellent observer at Newton, the details of the table are not so complete. The signal service has also made some important changes in its localities.

We have thought best this year to give the record of New York city as the nearest available indicator for the discontinued record of Sandy Hook, and also to add the record of Philadelphia. The Board is now in consultation with the detailed officer of the Signal Corps, in order to so combine these tables for series of years and so to equate any omissions as to have them as perfect as possible for use in larger comparisons. We are, as before, indebted to the several observers whose names are given.

STATION, NEWTON, N. J.

Latitude, 41° 2′ N.; Longitude, 74° 43′ W. Height of Barometer Cistern above Sea Level, 660 feet.

OBSERVERS, MISS E. FOSTER and MR. FOSTER.

	BAROMETER. Reduced to 32°.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1886.												
July	....	....	....	96.9	51.2	73.2	63.0	S W.	3.84	....	11	10
August	....	....	....	89.8	47.8	70.0	....	S W.	4.14	....	8	2
September	....	....	....	84.8	41.0	64.9	....	S. W.	1.76	....	8	4
October	....	....	....	76.6	26.0	53.3	63.0	S W.	2 85	....	10	4
November	....	....	....	69.2	21.0	42.8	57.1	N. W.	6.24	....	9	7
December	....	....	....	49.2	8.0	26.4	60.1	N. W.	3.60	....	15	11
1887.												
January	....	....	....	54.0	0.7	25.2	64.7	S. W.	4.55	....	11	11
February	....	....	....	57 0	9 5	30.5	....	N. W.	....	....	....	....
March	....	....	....	52.0	13.0	31.2	....	N. W.	....	....	....	13
April	....	....	....	74.0	23.0	46.6	....	N W.	....	....	....	12
May	....	....	....	95.0	42.0	66.2	....	N. E. S. W.	1.23	....	4	7
June	....	....	....	95.0	44.0	69 7	....	S. W	4 25	....	9	12
For the year	....	....	....	96 9	0.7	50.0	....	S. W.	†32.46	....	‡120	[illegible]

* Including melted snow. † Ten months. ‡ Estimated.

STATION, PATERSON, N. J.

Latitude, 40° 55′ N.; Longitude, 74° 11′ W. Height of Barometer Cistern above Sea Level, 142 feet.

OBSERVER, WILLIAM FERGASON, CITY SURVEYOR.

	Barometer. Reduced to 32°.			Thermometer.			Mean Humidity.	Prevailing Wind.	Rain (Inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1886.												
July	......	......	......	84	66	73.	......	......	4.90	......	9	......
August	......	......	......	85	61	71.	......	......	2.34	......	6	......
September	......	......	......	71	61	69.	......	......	1.06	......	5	......
October	......	......	......	66	46	55.	......	......	3.01	......	6	......
November	......	......	......	50	35	40.	......	......	3.85	......	8	......
December	......	......	......	40	17	28.	......	......	1.83	6	12	......
1887.												
January	......	......	......	60	40	25.75	......	......	3.96	4	13	......
February	......	......	......	63	16	33.	......	......	6.24	5	10	......
March	......	......	......	50	19	29.	......	......	2.11	2	8	......
April	......	......	......	79	28	45.	......	......	2.06	3	8	......
May	......	......	......	85	48	63.75	......	......	4.38	......	6	......
June	......	......	......	89	56	81.	......	......	5.96	......	11	......
For the year.	......	......	......	89	16	51.4	......	......	41.68	20	102	......

* Including melted snow.

STATION, NEW YORK CITY, N. Y.

Latitude, 40° 43′ N.; Longitude, 74° 0′ W. Height of Barometer Cistern above Sea Level, 168 feet.

OBSERVER, U. S. SIGNAL SERVICE.

	Barometer. Reduced to 32°.			Thermometer.			Mean Humidity.	Prevailing Wind.	Rain (Inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1886.												
July	30.081	29.572	29.785	90.5	60.6	73.9	70.	S.	2.57	......	10	6
August	30.169	29.442	29.816	87.7	57.8	71.0	72.	S.	1.16	......	6	3
September	30.267	29.547	29.965	85.9	50.5	67.1	74.	S.	1.79	......	7	7
October	30.352	29.620	30.000	82.5	34.6	56.5	70.	N. N. E.	3.90	......	7	8
November	30.283	29.310	29.837	72.7	28.6	45.3	69.	N. W.	4.61	1	9	8
December	30.408	29.272	29.949	54.2	14.0	30.8	75.	N. E.	3.73	8	13	10
1887.												
January	30.468	29.240	29.868	62.6	6.0	30.1	71.	N. W.	4.19	4	11	11
February	30.757	29.085	30.026	63.0	16.6	33.7	68.	N. W.	5.26	14	16	12
March	30.598	29.032	29.757	49.6	16.3	34.3	61.	N. W.	3.51	8	10	9
April	30.505	29.023	29.820	80.3	25.8	47.7	56.	N. W.	3.67	3	12	7
May	30.16	29.41	29.886	87.5	47.2	62.9	64.	S. E.	0.99	......	5	5
June	30.14	29.46	29.826	90.1	51.3	66.2	70.	S. E.	7.70	......	11	6
For the year.	30.757	29.023	29.878	90.5	6.0	51.7	68.3	N. W.	43.10	38	117	92

* Including melted snow.

STATION, NEWARK, N. J.

Latitude, 40° 44′ N.; Longitude, 74° 10′ W. Height of Barometer Cistern above Sea Level, 53 feet.

OBSERVER, F. W. RICORD.

	BAROMETER. Reduced to 32°.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches) *	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1886.												
July	30.250	29.760	29.972	91	69.	75.43	....	N.E., N.W.	4.780	....	6	7
August	30.320	29.670	29.984	90	55.	73.33	....	N.W., S.W.	1.570	....	3	4
September	30.430	29.720	30.134	86	50.	68.73	....	N.E., N.W.	1.630	....	6	8
October	30.520	29.810	30.169	78	36.	57.93	....	N.E., N.W.	2.910	....	4	10
November	30.430	29.490	30.000	66	27.	44.96	....	N.W., S.W.	4.860	3	5	9
December	30.540	29.490	30.121	52	14.	29.35	....	N.W., S.W.	4.250	8	7	17
1887.												
January	30.590	29.470	29.897	60	5.50	28.84	....	N.W., S.W.	3.630	5	9	14
February	30.960	29.320	30.220	63	16.	33.50	....	N.E., N.W.	5.430	7	10	15
March	30.750	29.270	29.276	50	17.	34.21	....	N.E., N.W.	3.620	7	6	17
April	30.650	29.200	29.994	80	30.	48.18	....	N.E., N.W.	3.120	3	7	13
May	30.310	29.630	30.067	88	46.	65.30	....	N.E., S.E.	.580	....	4	10
June	30.350	29.700	30.027	92	50.	69.70	....	N.E., S.E.	7.000	....	10	10
For the year	30.960	29.200	29.988	91	5.5	52.46	....	N.E., N.W.	43.38	33	81	134

* Including melted snow.

STATION, NEW BRUNSWICK, N. J.

Latitude, 40° 29′ N.; Longitude, 74° 27′ W. Height of Barometer Cistern above Sea Level, 115 feet.

OBSERVER, GEO. H. COOK.

	BAROMETER. Reduced to 32°.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1886.												
July	....	....	....	93.0	51.0	72.3	....	....	4.26	....	10	11
August	....	....	....	90.0	49.0	70.2	....	....	2.51	....	5	3
September	....	....	....	91.0	44.0	66.0	....	....	1.23	....	8	7
October	....	....	....	78.8	24.0	54.7	....	....	2.28	....	7	8
November	....	....	....	75.0	20.5	43.1	....	....	3.98	....	8	8
December	....	....	....	49.0	6.0	26.9	....	....	3.30	....	15	14
1887.												
January	....	....	....	59.0	1.5	27.2	....	....	4.44	....	12	12
February	....	....	....	62.0	10.0	32.1	....	....	5.65	....	17	18
March	....	....	....	50.5	16.0	33.3	....	....	3.23	....	11	14
April	....	....	....	82.5	25.0	47.1	....	....	3.04	....	9	12
May	....	....	....	86.5	39.0	62.5	....	....	1.11	....	7	7
June	....	....	....	90.5	47.0	68.0	....	....	5.98	....	11	12
For the year.	....	....	....	93.0	1.5	50.3	....	....	41.01	....	120	126

* Including melted snow.

STATION, BEVERLY, N. J.

Latitude, 40° 31′ N.; Longitude, 74° 59′ W. Height of Barometer Cistern above Sea Level, 40 feet.

OBSERVER, C. F. RICHARDSON.

	Barometer. Reduced to 32°.			Thermometer.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1886.												
July	30.59	30.04	30.22	92	59.	73.5	78.9	S. W.	5.55	....	15	11
August	30.61	29.95	30.24	92	56.	71.63	78.2	N. W.	2.15	....	6	14
September	30.60	30.01	30.35	88	38.	67.7	77.5	N. W.	1.29	....	8	11
October	30.64	29.94	30.32	80	29.	55.9	76.2	N. E.	2.86	....	5	10
November	30.47	29.61	30.12	71	22.	43.8	73.8	W.	4.04	....	9	11
December	30.45	29.65	30.14	53	6.5	28.2	81.8	N. E.	3.35	....	12	16
1887.												
January	30.52	29.65	30.08	63	4.	28.9	74.5	N. W.	2.30	....	10	13
February	30.75	29.63	30.25	67	15.	34.9	80.5	N. W.	4.99	....	14	11
March	30.76	29.46	30.04	55	21.	34.5	72.1	N. W.	3.25	....	12	14
April	30.72	29.54	30.15	83	29.	48.0	63.8	N. W.	2.60	....	12	16
May	30.51	29.89	30.27	87	52.	65.2	71.0	N. E.	1.50	....	8	15
June	30.55	29.99	30.27	94	56.	70.0	73.4	S. W.	5.64	....	13	12
For the year.	30.76	29.46	30.20	94	4.0	51.8	75.0	N. W.	40.52	....	124	154

* Including melted snow.

STATION, PHILADELPHIA, PA.

Latitude, 39° 57′ N.; Longitude, 75° 9′ W. Height of Barometer Cistern above Sea Level, 117 feet.

OBSERVER, U. S. SIGNAL SERVICE.

	Barometer. Reduced to 32°.			Thermometer.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1886.												
July	30.145	29.622	29.831	93.8	59.3	74.6	73.	S.	4.23	....	12	5
August	30.217	29.520	29.870	91.8	56.1	73.2	77.	S.	1.34	....	6	7
September	30.316	29.599	30.020	90.6	51.2	69.2	70.	S.	1.20	....	9	6
October	30.424	29.698	30.060	83.7	36.8	58.2	67.	N. W.	1.89	....	6	8
November	30.352	29.378	30.028	72.7	28.9	46.5	61.	N. W.	3.91	1	10	8
December	30.479	29.386	30.020	55.3	12.9	31.0	71.	N. W.	3.09	5	12	10
1887.												
January	30.538	29.303	29.947	65.6	8.1	31.5	69.	N. W.	3.23	8	13	7
February	30.323	29.252	30.107	65.6	18.0	36.1	77.	N. W.	4.43	8	17	13
March	30.632	29.192	29.855	54.5	21.8	36.4	64.	N. W.	2.59	10	14	10
April	30.549	29.142	29.897	84.2	27.8	49.8	58.	N. W.	2.00	3	11	8
May	30.22	29.49	29.936	87.9	48.7	66.7	63.	E.	0.62	....	8	6
June	30.22	29.56	29.905	93.1	53.2	70.9	67.	E.	6.81	....	12	7
For the year.	30.623	29.142	29.956	93.8	8.1	53.7	68.1	N. W.	35.38	35	130	99

* Including melted snow.

STATION, VINELAND, N. J.

Latitude, 39° 29′ N.; Longitude, 75° 1′ W. Height of Barometer Cistern above Sea Level, 105 feet.

OBSERVER, O. H. ADAMS, M.D.

	BAROMETER. Reduced to 32°.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1886.												
July	30.114	29.651	29.853	91	56	75.67	82.88	N. E., S. W.	6.467	....	10	7
August	30.218	29.571	29.842	90	58	72.98	84.15	S. W., N. E.	4.523	....	7	5
September	30.272	29.741	29.913	86	52	68.17	78.01	S. W., N. E.	1.243	....	4	4
October	30.380	29.751	30.066	77	34	57.06	77.78	N. E., S. W.	2.865	....	6	7
November	30.241	29.456	29.895	68	24	44.14	75.94	S. W.	3.798	....	6	7
December	30.426	29.543	30.037	58	10	30.86	70.29	N. E.	3.763	4	12	13
1887.												
January	30.482	29.505	29.980	64	6	32.00	74.86	N. W.	3.126	2	8	10
February	30.703	29.508	30.148	67	14	37.51	77.77	N. E.	3.939	....	8	11
March	30.287	29.421	29.876	56	18	37.93	72.79	N. W.	2.563	....	6	9
April	30.486	29.564	30.011	69	18	51.47	70.50	N. W., N. E.	4.066	1	7	11
May	30.202	29.525	29.911	84	43	67.24	70.65	N. E., S. W.	2.358	....	4	5
June	30.289	29.609	29.948	92	45	70.70	74.75	N. E., S. W.	6.251	....	8	4
For the year.	30.703	29.421	29.959	92	6	53.64	75.86	S. W.	44.982	7	86	96

* Including melted snow.

STATION, ATLANTIC CITY, N. J.

Latitude, 39° 22′ N.; Longitude, 74° 25′ W. Height of Barometer Cistern above Sea Level, 13 feet.

OBSERVER, U. S. SIGNAL SERVICE.

	BAROMETER. Reduced to 32°.			THERMOMETER.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1886.												
July	30.258	29.728	29.945	86.1	58.3	72.1	86	S. W.	4.73	....	9	7
August	30.313	29.579	29.952	86.5	55.3	71.4	84	S. W.	3.58	....	11	8
September	30.414	29.753	30.127	85.6	49.8	68.5	82	E. S. W.	0.89	....	5	6
October	30.512	29.808	30.161	73.9	36.2	58.1	82	N. W.	8.16	....	7	7
November	30.461	29.502	30.032	65.0	24.4	46.7	78	W. N. W.	3.45	....	9	6
December	30.565	29.510	30.115	51.4	13.7	33.2	85	N. W.	3.93	5	14	18
1887.												
January	30.640	29.424	30.066	49.4	7.0	31.4	82	S. W.	3.80	1	9	8
February	30.947	29.343	30.214	57.8	16.7	36.6	83	S. W.	4.17	4	15	6
March	30.742	29.153	29.953	56.2	18.4	35.6	80	N. W.	2.94	8	14	6
April	30.651	29.246	30.006	84.0	26.6	46.3	83	N. W.	2.85	3	13	6
May	30.33	29.62	30.055	73.3	46.7	59.1	85	S.	1.61	....	8	3
June	30.32	29.67	30.02	95.1	53.7	66.1	84	S. S. W.	4.21	....	10	7
For the year.	30.947	29.153	30.051	95.1	7.0	52.1	83	S. W.	44.02	21	126	78

* Including melted snow.

NOTE.—In the ninth report, owing to the discontinuance of the Signal Station Records at Cape May, we were unable to give the whole of the year. We this year, in addition to the tables for 1885–1886 therein given, print also the record of Atlantic City for that year.

STATION, ATLANTIC CITY, N. J., 1885–6.

Latitude, 39° 22′ N.; Longitude, 74° 25′ W. Height of Barometer Cistern above Sea Level, 13 feet.

OBSERVER, U. S. SIGNAL SERVICE.

	Barometer. Reduced to 32°.			Thermometer.			Mean Humidity.	Prevailing Wind.	Rain (inches).*	Snow (days of).	Days when Precipitation equaled 0.01.	Cloudy Days.
	Max.	Min.	Mean.	Max.	Min.	Mean.						
1885.												
July	30.199	29.650	29.946	90.9	56.8	73.4	87.	S.	4.45	....	6	1
August	30.271	29.664	29.970	89.3	45.8	73.1	83.	S.	6.50	....	13	4
September	30.369	29.425	30.074	80.6	44.0	64.7	80.	N. E.	1.59	....	6	3
October	30.326	29.104	30.014	73.9	33.6	55.8	86.	S.	2.94	1	11	5
November	30.361	29.562	29.944	64.7	26.8	46.4	83.	W.	6.84	2	14	9
December	30.728	29.279	30.025	53.3	12.5	36.9	82.	W.	4.29	1	9	5
1886.												
January	30.808	28.799	30.041	52.8	2.1	29.7	83.	N. W.	3.17	4	14	7
February	30.504	29.275	30.070	50.3	-2.3	29.9	79.	N. W.	4.92	5	7	7
March	30.461	29.262	29.931	67.5	10.6	38.1	78.	N. W.	3.40	3	10	4
April	30.530	29.402	30.100	83.4	28.4	48.0	82.	E.	1.86	....	6	5
May	30.363	29.511	29.922	74.9	40.5	56.0	82.	S. W.	4.15	....	9	11
June	30.318	29.510	29.977	82.0	50.3	65.7	83.	S. E.	2.56	....	10	6
For the year	30.808	28.799	30.001	90.9	-2.3	51.5	82.3	S. W. & S.	44.67	16	126	67

* Including melted snow.

NUMBER OF MARRIAGES, BIRTHS AND DEATHS BY TOWNSHIPS AND COUNTIES, AND TOTALS FOR THE STATE.

FOR THE YEAR ENDING JUNE 30, 1887.

ATLANTIC COUNTY.

	M.	B.	D.
Absecon	5	18	16
Atlantic City	165	231	214
Buena Vista	3	14	10
Egg Harbor City	16	47	20
Egg Harbor Township	52	94	62
Galloway	4	42	44
Hamilton	9	39	26
Hammonton	27	65	33
Mullica	3	18	8
Weymouth	1	15	9
	285	578	442

BERGEN COUNTY.

	M.	B.	D.
Englewood	84	72	89
Franklin	9	29	32
Harrington	17	49	33
Hohokus	4	41	42
Lodi	24	106	58
Midland	3	28	36
New Barbadoes	45	130	115
Orvil	9	15	17
Palisade	16	40	28
Ridgefield	30	69	61
Ridgewood	8	19	25
Saddle River	2	30	15
Union	11	60	66
Washington	12	52	46
	224	785	663

BURLINGTON COUNTY.

	M.	B.	D.
Bass River	8	27	13
Beverly	81	51	46
Bordentown	55	180	78
Burlington	93	126	188
Chester	26	64	58
Chesterfield	9	21	21
Cinnaminson	12	59	84
Delran	5	80	87
Eastampton	1	10	7
Evesham	8	26	28
Florence	8	55	29
Little Egg Harbor	11	82	22
Lumberton	1	19	5
Mansfield	11	87	24
Medford	6	80	87
Mount Laurel	1	18	18
New Hanover	17	56	36
Northampton	48	105	111
Pemberton	7	47	67
Randolph	2	18	8
Shamong	2	9	17
Southampton	6	89	16
Springfield	8	80	26
Washington	...	10	2
Westampton	...	7	9
Willingboro	7	7	9
Woodland	...	...	4
	868	1,058	880

CAMDEN COUNTY.

	M.	B.	D.
Camden	4,780	928	1,079
Centre	5	40	31
Delaware	2	18	16
Gloucester City	56	182	137
Gloucester	19	78	77
Haddon	89	95	57
Stockton	86	94	89
Waterford	12	49	81
Winslow	18	41	31
	4,912	1,475	1,548

CAPE MAY COUNTY.

	M.	B.	D.
Cape May City	18	39	44
Dennis	14	58	24
Lower	12	45	31
Middle	20	58	52
Upper	17	22	23
	81	212	174

CUMBERLAND COUNTY.

	M.	B.	D.
Bridgeton	92	274	163
Commercial	16	57	13
Deerfield	19	24	11
Downe	11	38	18
Fairfield	9	40	11
Greenwich	6	23	26
Hopewell	7	36	20
Landis	76	171	115
Lawrence	...	32	29
Maurice River	12	62	33
Millville	97	279	146
Stoe Creek	...	27	6
	345	1,063	591

ESSEX COUNTY.

	M.	B.	D.
Belleville	27	59	73
Bloomfield	64	167	99
Caldwell	21	26	28
Clinton	18	50	42
East Orange	74	177	126
Franklin	1	19	8
Livingston	9	16	20
Millburn	11	44	28
Montclair	22	54	45
Newark	1,468	4,540	3,734
Orange	149	468	332
South Orange	19	67	38
West Orange	7	68	42
	1,885	5,755	4,615

GLOUCESTER COUNTY.

	M.	B.	D.
Clayton	21	64	45
Deptford	5	38	18
East Greenwich	15	25	37
Franklin	8	62	39
Glassboro	24	74	46
Greenwich	8	47	19
Harrison	14	38	30
Logan	6	34	16
Mantua	14	25	24
Monroe	18	31	34
South Harrison	2	18	8
Washington	6	22	16
West Deptford	1	26	28
Woodbury	45	84	50
Woolwich	15	59	30
	202	647	443

HUDSON COUNTY.

	M.	B.	D.
Bayonne	99	298	308
Guttenberg	19	46	33
Harrison	27	249	182
Hoboken	418	1,173	916
Jersey City	1,212	2,566	3,666
Kearny	8	81	70
North Bergen	15	60	201
Town of Union	124	264	191
Union	14	69	32
Weehawken	3	28	44
West Hoboken	57	226	141
	1,996	5,060	5,799

HUNTERDON COUNTY.

	M.	B.	D.
Alexandria	7	23	13
Bethlehem	14	40	43
Clinton	25	59	28
Delaware	30	39	28
East Amwell	9	26	25
Franklin	9	26	9
Frenchtown	25	21	15
High Bridge	15	23	14
Holland	24	13	20
Kingwood	9	27	24
Lambertville	62	86	63
Lebanon	26	57	52
Raritan	37	57	57
Readington	39	43	38
Tewksbury	15	36	16
Union	5	10	16
West Amwell	3	18	20
	354	604	481

MERCER COUNTY.

	M.	B.	D.
Chambersburg	100	172	178
East Windsor	23	40	39
Ewing	10	19	51
Hamilton	16	32	62
Hopewell	81	69	60
Lawrence	4	23	27
Millham	11	77	37
Princeton	34	70	66
Trenton	549	632	612
Washington	4	12	14
West Windsor	11	14	19
	793	1,060	1,215

MIDDLESEX COUNTY.

	M.	B.	D.
Cranbury	19	34	25
East Brunswick	27	77	40
Madison	...	21	18
Monroe	15	41	33
New Brunswick	145	386	350
North Brunswick	17	22	20
Perth Amboy	61	176	150
Piscataway	21	54	34
Raritan	16	55	45
Sayreville	8	14	12
South Amboy	14	100	60
South Brunswick	10	45	37
Woodbridge	20	82	70
	373	1,107	889

MONMOUTH COUNTY.

	M.	B.	D.
Atlantic	7	18	19
Eatontown	9	23	35
Freehold	46	79	86
Holmdel	7	26	15
Howell	18	44	42
Long Branch	59	141	72
Manalapan	14	40	27
Marlboro	4	23	35
Matawan	24	68	71
Middletown	28	89	81
Millstone	14	32	28
Neptune	81	89	122
Ocean	12	32	49
Raritan	32	112	75
Shrewsbury	83	183	136
Upper Freehold	28	37	57
Wall	48	87	75
	514	1,123	1,025

MORRIS COUNTY.

	M.	B.	D.
Boonton	26	33	59
Chatham	33	83	65
Chester	15	70	30
Hanover	19	58	124
Jefferson	4	8	27
Mendham	10	28	24
Montville	6	9	11
Morristown	53	158	119
Mount Olive	6	30	16
Passaic	12	20	25
Pequannock	11	56	26
Randolph	55	145	106
Rockaway	24	104	107
Roxbury	17	70	57
Washington	22	65	20
	313	937	816

OCEAN COUNTY.

	M.	B.	D.
Berkeley	1	18	10
Brick	34	62	57
Dover	35	51	36
Eagleswood	0	9	9
Jackson	12	37	20
Lacey	5	13	12
Manchester	7	24	19
Ocean	...	8	9
Plumsted	6	24	23
Stafford	5	4	5
Union	16	27	11
	130	277	211

PASSAIC COUNTY.

	M.	B.	D.
Acquackanonk	8	29	17
Little Falls	16	39	39
Manchester	...	28	16
Passaic	99	288	180
Paterson	708	1,839	1,402
Pompton	15	35	32
Wayne	2	30	25
West Milford	12	28	29
	860	2,316	1,7[illegible]

SALEM COUNTY.

	M.	B.	D.
Alloway	3	19	21
Elsinboro	1	2	5
Lower Alloways Creek	7	8	14
Lower Penns Neck	...	15	13
Mannington	3	28	33
Oldmans	14	81	10
Pilesgrove	26	49	67
Pittsgrove	12	67	27
Quinton	3	33	9
Salem	76	104	85
Upper Penns Neck	25	41	31
Upper Pittsgrove	4	19	21
	174	416	340

SOMERSET COUNTY.

	M.	B.	D.
Bedminster	12	88	26
Bernards	18	48	40
Branchburg	4	16	19
Bridgewater	81	187	159
Franklin	17	58	52
Hillsborough	16	22	45
Montgomery	12	29	29
North Plainfield	25	89	48
Warren	7	14	18
	187	446	436

SUSSEX COUNTY.

	M.	B.	D.
Andover	10	16	19
Byram	16	82	11
Frankford	9	27	26
Green	6	12	11
Hampton	8	6	15
Hardyston	26	6	31
Lafayette	7	6	16
Montague	6	12	15
Newton	31	37	22
Sandyston	11	19	21
Sparta	8	9	19
Stillwater	15	26	19
Vernon	11	25	15
Walpack	6	9	4
Wantage	26	46	52
	191	288	296

UNION COUNTY.

	M.	B.	D.
Clark	...	8	6
Cranford	...	2	2
Elizabeth	242	885	717
Fanwood	1	19	12
Linden	7	20	81
New Providence	1	9	11
Plainfield	88	169	158
Rahway	51	126	116
Springfield	9	17	21
Summit	17	55	48
Union	5	82	28
Westfield	19	55	50
	440	1,892	1,190

WARREN COUNTY.

	M.	B.	D.
Allamuchy	...	9	5
Belvidere	50	32	22
Blairstown	13	28	21
Franklin	4	20	20
Frelinghuysen	4	21	7
Greenwich	5	18	15
Hackettstown	24	41	29
Hardwick	...	8	8
Harmony	10	28	18
Hope	12	42	20
Independence	6	20	8
Knowlton	90	31	21
Lopatcong	2	30	30
Mansfield	7	16	25
Oxford	24	120	71
Pahaquarry	1	2	2
Phillipsburg	492	210	155
Pohatcong	8	27	28
Washington	87	98	40
	789	791	546

TOTALS OF MARRIAGES, BIRTHS AND DEATHS FOR ALL THE COUNTIES.

	M.	B.	D.
Atlantic	285	578	442
Bergen	224	785	663
Burlington	868	1,068	880
Camden	4,912	1,475	1,548
Cape May	81	212	174
Cumberland	345	1,063	591
Essex	1,885	5,755	4,615
Gloucester	202	647	443
Hudson	1,996	6,060	5,799
Hunterdon	354	604	451
Mercer	793	1,060	1,215
Middlesex	373	1,107	889
Monmouth	514	1,123	1,025
Morris	318	937	816
Ocean	130	277	211
Passaic	860	2,316	1,781
Salem	174	416	340
Somerset	187	446	436
Sussex	191	288	296
Union	440	1,392	1,190
Warren	789	791	546
	15,416	27,340	24,331

SPECIAL COMPARISON OF DEATH-RATES

AND OF DEATHS FROM SEVERAL DISEASES AND AT DIFFERENT AGES, AS SHOWING THE CONTRAST BETWEEN CITIES AND COUNTRY DISTRICTS.

The degree to which disease is preventable and the extent to which the average of human life may be prolonged, deserve to rank as one of the discoveries of the present age—as an epoch from which we are to reckon great progress in the art of preserving life.

Yet, like many discoveries, it has as yet only partial application. Its significance and its possibilities need to be enforced by various illustrations.

We first attempt to show it by numerical statements and comparisons. We tell the least number dying in the most healthy places and the greatest number in the most sickly places, and increase the significance of the figures by details as to the ages and the diseases; when, for instance, we find that in one district only 15 die yearly out of each 1,000 inhabitants and in another place 30 in 1,000, we cannot but see the contrast and begin to wonder whether the higher death-rate cannot be reduced. We cannot but see that it is dependent upon causes operating in the one place that are not operative in the other.

Even the figures do not convey the whole idea. We seem to forget that in populations of 100,000, the difference between the 15 per 1,000 in one locality and the 30 in another means the loss of just 1,500 lives.

The most impressive lesson would be to place the 1,500 excess of dead bodies in a row and then have some of them recognized as our friends, our relatives, as members of our own families. We then, perchance, would bestir ourselves more for the prevention of this excess. In order to impress these facts of statistics we have selected one of our cities, representing about 150,000 inhabitants, and four of our rural counties having no cities in them, representing about 100,-

000 people, so that allowance can easily be made for the third more in the city. We do not select the one city because of its excess over other cities, for some of our own exceed it. The counties are only a fair representation of our country districts.

We take the three years crossing the census of 1885, and reckon this series of years in order to avoid any error arising from the greater mortality of some one season or year, or error from dealing with too small numbers.

By five different tables we seek to show the facts in various phases and combination so as to admit of individual and comparative study and so illustrate and impress the general result.

In order to aid those who are more impressed by graphic delineations or by the eye more than by mere figures, we add in their proper places two diagrams, the one showing the mean annual comparative death-rates between the city and the counties at corresponding ages, and the other a comparison as to prominent or selected causes of death. These, together, show not only the excesses of number in the city, but at what age the excesses have occurred, and also in what classes of disease the relative excess of cities is most marked. The diagrams also show the principal diseases in relation to each other.

The tables and the delineations together, can also be studied in many other directions.

The combinations of the tables have been made with the aid of the electrical combining machine invented by H. Hollerith, M.E., of Washington, D. C., and we are also indebted to him for assistance in the graphic comparisons.

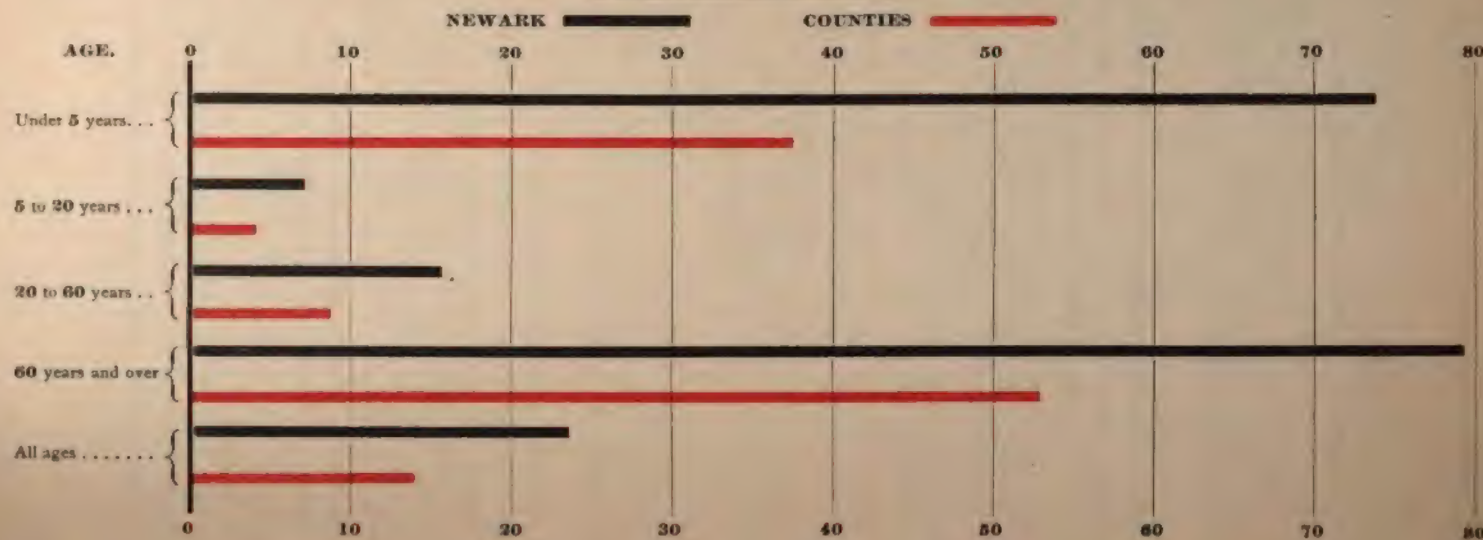
It is not claimed that these comparisons might not be slightly modified by absolutely correct returns or by comparisons of larger populations over a longer period of time. But the worker in statistics is constantly surprised to see how errors balance each other or can be allowed for, or how, in large calculations, they drop out as inconsiderable factors. The facts stated in general, so far from being exaggerated, lack fullness of statement, for populations are oftener overestimated than underestimated, and while no more deaths are recorded than occur, it cannot be assumed that absolutely all are secured. Besides, these deaths stand for multitudes of sicknesses of those who have not died, and for loss of comfort and of capital as well as of life. Newark, in comparison with many other cities, is not conspicuous for its death-rate, and we have found it convenient to use

DIAGRAM SHOWING THE MEAN ANNUAL DEATH-RATE

At certain ages per 1,000 of population at corresponding ages

For the City of Newark, as compared with Cape May, Gloucester, Hunterdon and Somerset Counties,

For three years from July 1st, 1883, to July 1st, 1886.



it all the more complacently because it is astir in grappling with its sanitary problems, and is showing a vigor of sanitary administration which promises to keep abreast of its wonderful capacities for increase.

The following table shows the total mortality for the city of Newark, and for the counties of Cape May, Gloucester, Hunterdon and Somerset, for the three years from July 1st, 1883, to July 1st, 1886:

	Newark.	Counties.
Total mortality, three years	10,779	4,386
Total population, census 1885	152,988	103,192
Mean annual death-rate per 1,000	23.49	14.17

To represent their mean annual death-rates graphically, we have the accompanying diagram. (See opposite page.)

If the rate of mortality in the counties had been the same as that for the city of Newark, we would have had a total mortality for the three years of 7,271, as against 4,386, the actual mortality in the counties during this period. Or if we apply the death-rate of the counties to the population of Newark we should have a total mortality for the three years of only 6,503, instead of the actual mortality of 10,779.

The distribution of the mortality with reference to age is shown in the following table, which gives the actual mortality and the percentage of the total mortality, at each age-period for the three years for the city of Newark and for the four counties:

AGE.	ACTUAL MORTALITY.		PERCENTAGE OF TOTAL MORTALITY.	
	Newark.	Counties.	Newark.	Counties.
Under one month	722	251	6.70	5.72
One month to one year	1,892	556	17.55	12.68
One to five years	1,717	406	15.93	9.26
Five to ten years	516	154	4.79	3.51
Ten to twenty years	501	227	4.65	5.17
Twenty to thirty years	971	342	9.01	7.80
Thirty to forty years	950	289	8.81	6.59
Forty to fifty years	883	299	8.19	6.82
Fifty to sixty years	814	329	7.55	7.50
Sixty to seventy years	827	488	7.67	11.12
Seventy to eighty years	607	603	5.63	13.75
Eighty years and over	347	409	3.22	9.33
Unknown	32	33	.30	.75
All ages	10,779	4,386	100.00	100.00

The actual living population in the city of Newark and in the counties at certain age-periods, according to the census of 1885, and the percentage of the total at each age-period, are given in the following table:

AGE.	POPULATION.		PERCENTAGE OF TOTAL MORTALITY.	
	Newark.	Counties.	Newark.	Counties.
Under five years	19,610	10,887	12.82	10.55
Five to twenty years	47,643	32,769	31.14	31.76
Twenty to sixty years	78,229	50,070	51.13	48.52
Sixty years and over	7,506	9,466	4.91	9.17
Total	152,988	103,192	100.00	100.00

The following table gives the total mortality for the three years, for Newark and for the counties, for corresponding age-periods. Those of unknown age have been distributed in proportion to those of known ages:

AGE.	Newark.	Counties.
Under five years	4,344	1,22[illegible]
Five to twenty years	1,020	[illegible]
Twenty to sixty years	3,629	1,2[illegible]
Sixty years and over	1,786	1,511
All ages	10,779	4,3[illegible]

From these figures we get the *mean annual death-rate* per 1,000 living population *at each age-period*, as follows:

AGE.	DEATH-RATE PER 1,000.	
	Newark.	Counties.
Under five years	73.84	37.41
Five to twenty years	7.14	2.91
Twenty to sixty years	15.46	8.45
Sixty years and over	79.32	53.20
All ages	23.49	14.17

The following table shows the mortality, exclusive of infants under one month of age, and the percentage of the total mortality from each cause for the three years for the city of Newark and for the counties:

CAUSES.	ACTUAL MORTALITY.		PERCENTAGE.	
	Newark.	Counties.	Newark.	Counties.
Remittent fever	99	53	.99	1.28
Typhoid fever	283	92	2.81	2.23
Small-pox	1	......	.01	......
Scarlet fever	162	81	1.61	1.96
Measles	80	8	.79	.19
Whooping-cough	77	44	.76	1.06
Croup and diphtheria	884	142	8.79	3.43
Erysipelas	35	19	.35	.46
Diarrhœal diseases	1,205	385	11.98	9.31
Consumption	1,594	667	15.85	16.13
Acute lung diseases	1,240	389	12.33	9.41
Brain and nervous diseases of children	940	257	9.35	6.22
Diseases of heart and circulation	635	326	6.32	7.89
Urinary diseases	409	160	4.07	3.87
Adult brain and spinal diseases	726	523	7.22	12.65
Digestive and intestinal diseases	541	314	5.38	7.59
Cancer	257	135	2.55	3.26
Acute rheumatism	11	19	.11	.46
Puerperal	116	54	1.15	1.31
Accident	397	206	3.95	4.98
Not classified	196	91	1.95	2.20
Unknown	169	170	1.68	4.11
All causes	10,057	4,135	100.00	100.00

The following tables show in detail all the relations between cause, sex and age for the mortality of the city of Newark and of the four counties:

MORTALITY IN THE CITY OF NEWARK FOR THREE YEARS FROM JULY 1ST, 1883, TO JULY 1ST, 1886, ACCORDING TO CAUSE, SEX AND AGE (EXCLUSIVE OF INFANTS UNDER ONE MONTH OF AGE).

CAUSE.	SEX.	AGE.												Total.
		One month and under one year.	One to five years.	Five to ten years	Ten to twenty years.	Twenty to thirty years.	Thirty to forty years.	Forty to fifty years.	Fifty to sixty years.	Sixty to seventy years.	Seventy to eighty years.	Eighty years and over.	Not specified.	
Remittent fever	Males	4	13	2	4	2	7	5	3	2	2	1	......	45
	Females	5	10	4	3	9	9	4	3	1	2	4	......	54
	Totals	9	23	6	7	11	16	9	6	3	4	5	......	99
Typhoid fever	Males	3	2	7	30	50	26	16	9	6	6	......	2	157
	Females	1	2	11	30	31	21	14	5	4	6	1	......	126
	Totals	4	4	18	60	81	47	30	14	10	12	1	2	283
Small-pox	Males	......	1	......	......	......	......	......	......	......	......	......	......	1
	Females	......	......	......	......	......	......	......	......	......	......	......	......	......
	Totals	......	1	......	......	......	......	......	......	......	......	......	......	1
Scarlet fever	Males	4	61	13	3	1	1	......	......	......	......	......	......	83
	Females	3	44	31	1	......	......	......	......	......	......	......	......	79
	Totals	7	105	44	4	1	1	......	......	......	......	......	......	162
Measles	Males	7	28	3	......	......	......	......	......	......	......	......	......	38
	Females	7	28	6	......	......	1	......	......	......	......	......	......	42
	Totals	14	56	9	......	......	1	......	......	......	......	......	......	80
Whooping-cough	Males	19	14	1	......	......	......	......	......	......	......	......	......	34
	Females	25	14	4	......	......	......	......	......	......	......	......	......	43
	Totals	44	28	5	......	......	......	......	......	......	......	......	......	77
Croup and diphtheria	Males	30	302	96	13	3	1	......	1	1	......	......	1	449
	Females	33	261	114	19	3	......	2	......	1	......	......	1	434
	Unknown	......	......	1	......	......	......	......	......	......	......	......	......	1
	Totals	63	564	211	32	6	1	2	1	2	......	......	2	884
Erysipelas	Males	5	2	......	1	1	2	5	1	3	2	1	......	23
	Females	2	2	......	2	......	......	......	......	2	2	2	......	12
	Totals	7	4	......	3	1	2	5	1	5	4	3	......	35
Diarrhœal diseases	Males	505	119	12	26	......	......	......	......	......	......	......	......	662
	Females	405	107	12	16	......	......	......	......	......	......	......	......	540
	Unknown	3	......	......	......	......	......	......	......	......	......	......	......	3
	Totals	913	226	24	42	......	......	......	......	......	......	......	......	1,205

MORTALITY IN THE CITY OF NEWARK—*Continued.*

Cause.	Sex.	Age: One month and under one year.	One to five years.	Five to ten years.	Ten to twenty years.	Twenty to thirty years.	Thirty to forty years.	Forty to fifty years.	Fifty to sixty years.	Sixty to seventy years.	Seventy to eighty years.	Eighty years and over.	Not specified.	Total.
Consumption	Males	6	11	5	66	267	196	144	86	70	25	12	1	889
	Females	11	4	7	79	200	152	100	52	58	35	9	3	705
	Totals	17	15	12	145	467	348	244	138	128	60	21	4	1,594
Acute lung diseases	Males	148	148	27	14	44	63	84	66	50	31	17	1	693
	Females	114	113	20	17	26	36	42	49	68	39	23	......	547
	Totals	262	261	47	31	70	99	126	115	118	70	40	1	1,240
Brain and nervous diseases of children	Males	230	205	46	22	......	......	......	......	......	......	......	......	503
	Females	220	159	37	19	......	......	......	......	......	......	......	......	435
	Unknown	......	2	......	......	......	......	......	......	......	......	......	......	2
	Totals	450	366	83	41	......	......	......	......	......	......	......	......	940
Diseases of heart and circulation	Males	8	5	7	23	28	49	44	57	57	49	13	......	340
	Females	4	5	10	29	24	24	30	52	50	42	22	3	295
	Totals	12	10	17	52	52	73	74	109	107	91	35	3	635
Urinary diseases	Males	3	10	6	9	21	32	35	34	37	38	14	......	239
	Females	1	3	3	12	19	21	29	27	29	15	11	......	170
	Totals	4	13	9	21	40	53	64	61	66	53	25	......	409
Adult brain and spinal diseases	Males	......	......	......	......	26	46	48	78	87	65	30	2	382
	Females	......	......	......	......	21	31	51	56	62	78	41	4	344
	Totals	......	......	......	......	47	77	99	134	149	143	71	6	726
Digestive and intestinal diseases	Males	......	......	......	......	26	34	42	44	57	28	17	2	250
	Females	......	......	......	......	26	45	40	49	62	46	23	......	291
	Totals	......	......	......	......	52	79	82	93	119	74	40	2	541
Cancer	Males	......	1	......	......	2	7	20	20	25	15	6	......	96
	Females	......	......	......	......	2	16	32	50	39	19	3	......	161
	Totals	......	1	......	......	4	23	52	70	64	34	9	......	257
Acute rheumatism	Males	1	......	......	......	......	......	1	......	1	1	......	......	4
	Females	......	......	......	......	......	1	1	......	3	2	......	......	7
	Totals	1	......	......	......	......	1	2	......	4	3	......	......	11
Puerperal	Males	......	......	......	......	......	......	......	......	......	......	......	......	......
	Females	......	......	......	7	57	39	8	......	3	......	......	2	116
	Totals	......	......	......	7	57	39	8	......	3	......	......	2	116

MORTALITY IN THE CITY OF NEWARK—*Continued.*

CAUSE.	SEX.	AGE.												
		One month and under one year.	One to five years.	Five to ten years.	Ten to twenty years.	Twenty to thirty years.	Thirty to forty years.	Forty to fifty years.	Fifty to sixty years.	Sixty to seventy years.	Seventy to eighty years.	Eighty years and over.	Not specified.	Total.
Accident	Males	7	15	20	40	56	51	56	44	15	7	3	7	321
	Females	5	12	6	6	10	8	8	7	7	......	6	......	75
	Unknown	......	1	......	......	......	......	......	......	......	......	......	......	1
	Totals	12	28	26	46	66	59	64	51	22	7	9	7	397
Not classified	Males	32	4	4	4	8	15	12	10	6	7	4	2	108
	Females	22	4	1	4	6	14	5	6	11	7	7	1	88
	Totals	54	8	5	8	14	29	17	16	17	14	11	3	196
Unknown	Males	15	4	......	......	1	......	3	2	7	17	27	......	76
	Females	4	......	......	2	1	2	2	3	8	21	50	......	93
	Totals	19	4	......	2	2	2	5	5	15	38	77	......	169
All causes	Males	864	769	266	245	435	420	368	359	408	314	202	14	4,659
	Females	1025	945	249	256	536	530	515	455	424	293	145	18	5,391
	Unknown	3	3	1	......	......	......	......	......	......	......	......	......	7
	Totals	1892	1717	516	501	971	950	883	814	827	607	347	32	10,057

TOTAL MORTALITY IN CAPE MAY, GLOUCESTER, HUNTERDON AND SOMERSET COUNTIES FOR THREE YEARS FROM JULY 1ST, 1883, TO JULY 1ST, 1886, ACCORDING TO CAUSE, SEX AND AGE (EXCLUSIVE OF INFANTS UNDER ONE MONTH OF AGE).

CAUSE.	SEX.	AGE.												
		One month and under one year.	One to five years.	Five to ten years.	Ten to twenty years.	Twenty to thirty years.	Thirty to forty years.	Forty to fifty years.	Fifty to sixty years.	Sixty to seventy years.	Seventy to eighty years.	Eighty years and over.	Unknown.	Total.
Remittent fever........	Males.........	1	3	1	2	3	1	1	2	4	......	3	......	21
	Females.....	4	7	......	2	3	2	3	1	5	5	......	......	32
	Totals.........	5	10	1	4	6	3	4	3	9	5	3	......	53
Typhoid fever...........	Males.........	......	1	3	8	15	5	5	2	4	4	2	......	49
	Females.....	......	3	2	9	9	4	4	2	5	2	1	2	43
	Totals.........	......	4	5	17	24	9	9	4	9	6	3	2	92
Small-pox	Males.........	......	......	......	......	......	......	......	......	......	......	......	......	....
	Females.....	......	......	......	......	......	......	......	......	......	......	......	......	....
	Totals.........	......	......	......	......	......	......	......	......	......	......	......	......	....
Scarlet fever	Males.........	2	21	9	3	1	1	......	1	......	......	......	1	39
	Females.....	3	12	14	9	3	1	......	......	......	......	......	......	42
	Totals.........	5	33	23	12	4	2	......	1	......	......	......	1	81
Measles......................	Males.........	1	1	......	......	......	......	......	......	......	......	1	......	3
	Females.....	1	2	......	2	......	......	......	......	......	......	......	......	5
	Totals.........	2	3	......	2	......	......	......	......	......	......	1	......	8
Whooping-cough	Males.........	14	7	......	......	......	......	......	......	......	......	......	......	21
	Females.....	13	8	1	1	......	......	......	......	......	......	......	......	23
	Totals.........	27	15	1	1	......	......	......	......	......	......	......	......	44
Croup and diphtheria	Males.........	12	31	20	5	2	......	......	......	......	......	......	......	70
	Females.....	8	28	20	9	2	2	1	2	......	......	......	......	72
	Totals.........	15	64	40	14	4	2	1	2	......	......	......	......	142
Erysipelas.................	Males.........	2	1	......	......	1	1	......	1	2	2	2	......	12
	Females.....	2	......	......	......	......	......	......	1	......	1	3	......	7
	Totals	4	1	......	......	1	1	......	2	2	3	5	......	19
Diarrhœal diseases ...	Males.........	143	46	7	6	......	......	......	......	......	......	......	......	202
	Females.....	115	38	11	19	......	......	......	......	......	......	......	......	183
	Totals.........	258	84	18	25	......	......	......	......	......	......	......	......	385

TOTAL MORTALITY IN CAPE MAY, GLOUCESTER, HUNTERDON AND SOMERSET COUNTIES—*Continued.*

CAUSE.	SEX.	AGE.												
		One month and under one year.	One to five years.	Five to ten years.	Ten to twenty years.	Twenty to thirty years.	Thirty to forty years.	Forty to fifty years.	Fifty to sixty years.	Sixty to seventy years.	Seventy to eighty years.	Eighty years and over.	Unknown.	Total.
Consumption	Males	14	9	5	22	83	51	38	35	29	25	3	2	316
	Females	7	7	2	39	83	77	41	30	27	25	10	3	351
	Totals	21	16	7	61	166	128	79	65	56	50	13	5	667
Acute lung diseases...	Males	41	28	8	4	7	10	14	14	22	23	20	1	192
	Females.....	28	35	2	6	5	7	11	19	22	40	22	......	197
	Totals.........	69	63	10	10	12	17	25	33	44	63	42	1	389
Brain and nervous diseases of children	Males	67	39	14	15	......	......	......	......	......	......	......	......	135
	Females.....	43	51	14	14	......	......	......	......	......	......	......	......	122
	Totals.........	110	90	28	29	......	......	......	......	......	......	......	......	257
Diseases of heart and circulation...	Males	3	1	3	6	2	6	14	16	30	49	29	1	160
	Females.....	3	1	1	5	4	11	13	23	31	45	28	1	166
	Totals.........	6	2	4	11	6	17	27	39	61	94	57	2	326
Urinary diseases........	Males	1	1	......	3	3	3	7	17	24	31	10	......	100
	Females.....	1	2	3	5	7	5	7	4	8	12	5	1	60
	Totals.........	2	3	3	8	10	8	14	21	32	43	15	1	160
Adult brain and spinal diseases....	Males	......	......	......	......	8	7	19	23	52	87	43	1	240
	Females.....	......	......	......	......	13	13	20	22	63	82	69	1	283
	Totals.........	......	......	......	......	21	20	39	45	115	169	112	2	523
Digestive and intestinal diseases..	Males	......	......	......	......	7	12	7	22	47	28	16	2	141
	Females.....	......	......	......	......	18	8	18	24	40	37	25	3	173
	Totals.........	......	......	......	......	25	20	25	46	87	65	41	5	314
Cancer	Males	......	......	......	......	......	3	8	9	13	9	6	......	48
	Females	......	......	......	......	1	4	22	22	16	17	4	1	87
	Totals	......	......	......	......	1	7	30	31	29	26	10	1	135
Acute rheumatism ...	Males	......	......	......	1	1	1	......	2	1	3	2	......	11
	Females.....	......	......	......	......	......	1	......	2	2	2	1	......	8
	Totals.........	......	......	......	1	1	2	......	4	3	5	3	......	19
Puerperal..................	Males	......	......	......	......	......	......	......	......	......	......	......	......	......
	Females.....	......	......	......	4	19	17	6	4	3	1	......	......	54
	Totals.........	......	......	......	4	19	17	6	4	3	1	......	......	54

N AND

Unknown.	Total.
10	166
......	40
10	206
1	57
1	34
2	91
......	69
1	100
......	1
1	170
19	2,062
14	2,082
......	1
33	4,185

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TOTAL MORTALITY IN CAPE MAY, GLOUCESTER, HUNTERDON AND SOMERSET COUNTIES—*Continued.*

Cause.	Sex.	Age. One month and under one year.	One to five years.	Five to ten years.	Ten to twenty years.	Twenty to thirty years.	Thirty to forty years.	Forty to fifty years.	Fifty to sixty years.	Sixty to seventy years.	Seventy to eighty years.	Eighty years and over.	Unknown.	Total.
Accident	Males	3	6	10	20	26	23	21	17	20	8	2	10	166
	Females	1	4	......	4	4	2	4	2	2	7	10	......	40
	Totals	4	10	10	24	30	25	25	19	22	15	12	10	206
Not classified	Males	14	6	2	......	5	7	5	5	7	4	1	1	57
	Females	4	......	......	4	5	3	7	3	......	4	3	1	34
	Totals	18	6	2	4	10	10	12	8	7	8	4	2	91
Unknown	Males	8	......	......	......	......	......	......	1	4	24	32	......	69
	Females	1	2	2	......	2	1	3	1	5	26	56	1	100
	Unknown	1	......	......	......	......	......	......	......	......	......	......	......	1
	Totals	10	2	2	......	2	1	3	2	9	50	88	1	170
All causes	Males	326	201	82	95	164	131	189	167	259	297	172	19	2,052
	Females	229	205	72	132	178	158	160	162	229	306	237	14	2,082
	Unknown	1	......	......	......	......	......	...	......	......	......	......	......	1
	Totals	556	406	154	227	342	289	290	329	488	603	409	33	4,135

(See the diagram illustrating these results graphically, on opposite page.)

The comparison of the death-rates per 10,000 inhabitants from each cause for the counties and for Newark is shown in the following table. In computing the death-rates for the different causes the infants under one month of age were not included:

CAUSES.	MEAN ANNUAL DEATH-RATE PER 10,000 TOTAL POPULATION.	
	Newark.	Counties.
Remittent fever	2.16	1.71
Typhoid fever	6.17	2.97
Small-pox	.02	....
Scarlet fever	3.53	2.62
Measles	1.74	.26
Whooping-cough	1.68	1.42
Croup and diphtheria	19.26	4.59
Erysipelas	.76	.61
Diarrhœal diseases	26.25	12.44
Consumption	34.73	21.55
Acute lung diseases	27.02	12.56
Brain and nervous diseases of children	20.43	8.30
Diseases of heart and circulation	13.84	10.58
Urinary diseases	8.91	5.17
Adult brain and spinal diseases	15.82	16.89
Digestive and intestinal diseases	11.79	10.14
Cancer	5.60	4.36
Acute rheumatism	.24	.61
Puerperal	2.58	1.75
Accident	3.65	6.66
Not classified	4.27	2.94
Unknown	8.63	5.49
All causes	219.13	133.57
Infants under one month	15.73	8.11
Total mortality	234.86	141.68

RETURNS OF DEATHS FROM ALL CAUSES.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887—By Counties.

COUNTIES. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	Death-rate per 1,000, without cities of over 5,000.	Deaths under five in each 100, or comparison of these with total deaths.	Comparative number of deaths in each 100 from chief preventable diseases.
Atlantic	133	37	38	123	111	442	23,356	15.30	15.68	38.46	22.62
Bergen	140	77	70	189	187	663	39,880	16.62	....	32.73	24.89
Burlington	171	87	78	243	295	880	57,558	15.29	15.20	29.32	20.45
Camden	432	209	160	462	277	1,548	76,685	20.19	18.62	41.41	26.86
Cape May	30	15	14	41	68	174	10,744	16.20	......	25.86	20.11
Cumberland	148	67	46	174	154	591	41,982	14.08	12.21	36.38	20.47
Essex	1132	649	351	1616	851	4,615	213,764	21.59	12.05	38.59	23.47
Gloucester	99	57	22	130	142	444	27,603	16.05	....	35.21	18.74
Hudson	1572	1040	521	1959	686	5,799	240,342	24.13	25.02	45.04	28.37
Hunterdon	82	40	35	125	195	481	37,420	12.85	....	25.36	18.30
Mercer	244	162	91	370	292	1,215	66,785	18.19	17.81	36.71	21.15
Middlesex	216	98	79	250	230	889	56,180	15.82	12.31	35.32	23.85
Monmouth	234	119	106	288	270	1,025	62,324	16.45	16.67	34.63	24.88
Morris	143	83	69	257	230	816	50,675	16.10	16.83	27.70	16.42
Ocean	35	24	20	76	52	211	15,586	13.54	....	27.96	22.27
Passaic	341	286	150	540	296	1,731	83,374	20.76	11.80	43.00	22.41
Salem	77	30	32	78	115	340	25,373	13.40	12.64	31.47	19.71
Somerset	63	41	46	111	169	436	27,425	15.90	....	23.85	19.95
Sussex	47	31	14	83	114	296	22,401	13.21	....	26.35	13.85
Union	278	172	121	376	267	1,190	61,879	19.24	14.63	37.82	24.45
Warren	90	72	59	150	166	548	37,737	14.47	13.18	29.67	19.41
*Totals	5819	3396	2130	7624	5167	24,331	1,278,033	19.04	15.15	38.00	23.81

COUNTIES. Statistical Divisions.	PRINCIPAL CAUSES OF DEATH. Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Atlantic	3	8	1	2	6	4	11	4	61	38	40	22	23	39	15	29	23	11	1	4	26
Bergen	14	20	...	21	4	8	30	4	64	48	41	61	45	53	25	60	35	11	7	8	42
Burlington	7	28	...	6	6	13	40	5	75	53	57	83	44	69	28	106	57	24	8	6	30
Camden	14	84	..	16	12	11	94	...	197	99	133	140	126	71	53	127	76	25	6	13	72
Cape May	2	......	...	8	1	3	4	1	16	11	8	18	5	10	4	31	14	8	1	2	8
Cumberland	3	12	...	4	4	6	22	5	65	55	63	47	37	46	21	40	34	17	7	5	17
Essex	24	101	2	42	78	24	277	14	521	469	315	480	395	315	210	344	197	125	19	50	170
Gloucester	......	9	...	2	1	5	21	3	42	33	36	39	31	32	10	44	36	17	2	2	18
Hudson	63	118	1	30	52	31	547	22	781	408	357	719	543	282	177	294	260	104	24	57	250
Hunterdon	6	7	...	14	6	......	19	...	36	36	40	36	18	45	18	73	32	19	3	8	20
Mercer	8	24	...	12	54	9	41	9	100	99	77	137	83	71	44	125	58	34	8	19	51
Middlesex	11	16	..	7	9	10	41	3	115	76	66	52	74	53	38	67	38	20	6	11	49
Monmouth	10	18	...	2	8	20	82	2	113	68	87	93	44	66	26	84	83	29	8	14	46
Morris	7	16	...	7	11	5	29	6	53	52	60	85	43	54	27	127	61	20	6	10	51
Ocean	3	10	...	......	4	......	11	1	18	24	20	12	12	14	7	22	16	4	1	6	8
Passaic	11	39	...	17	11	20	115	5	179	139	119	210	176	101	65	124	76	29	5	15	71
Salem	1	10	...	......	......	......	12	2	42	28	35	31	16	23	13	36	19	10	4	3	10
Somerset	3	5	...	23	9	1	17	2	27	20	45	43	16	30	24	56	31	11	1	3	20
Sussex	4	3	...	2	2	2	2	2	24	25	21	49	8	31	6	42	18	10	......	5	6
Union	20	17	...	16	10	5	93	3	127	84	92	121	99	87	44	84	44	31	10	15	59
Warren	3	6	1	24	8	4	19	3	38	45	31	49	48	38	18	51	34	15	5	7	27
*Totals	217	522	5	255	296	181	1527	96	2694	1910	1743	2567	1886	1530	873	1966	1242	674	132	263	1051

* Of those dying under one year, 1,714 died under one month, of which 1,162 died in the larger cities. Of those dying under one year, 4,131 died in the larger cities. Of the 9,215 that died under five years, 6,574 died in the larger cities. Total death-rate from Consumption for the State, as compared with total deaths, 15.01, the deaths being 2,361 in cities, and 1,292 outside. Rates for short periods, or which deal with small numbers, are only approximate, since temporary causes may have been in operation, and small numbers do not eliminate or balance errors which practically disappear in large aggregates. The number of deaths before 20, in proportion to the rest, are much more informatory as to local causes affecting health than the total deaths. See, also, the number dying from the communicable diseases.

Return of Deaths from all Causes and Certain Specified Diseases, in the Cities of the State of New Jersey, of over 5,000 Population, for the Year ending June 30th, 1887.

CITIES HAVING OVER 5,000 POPULATION. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	Deaths under five in each 100, or comparison of these with total deaths	Comparative number of deaths in each 100 from chief preventable diseases.
Atlantic County.										
Atlantic City	77	30	16	64	33	216	7,942	27.20	44.91	22.69
Burlington County.										
Bordentown	15	3	3	33	24	78	5,857	13.32	23.08	8.41
Burlington	27	22	13	36	34	133	7,690	17.30	36.84	32.33
Camden County.										
Camden City	307	141	120	337	178	1079	52,884	20.40	41.53	25.67
Gloucester City	44	24	13	42	14	137	5,966	22.96	49.64	35.77
Cumberland County.										
Bridgeton	48	19	8	47	40	163	10,065	16.19	41.10	17.79
Millville	30	25	15	42	34	146	8,824	16.55	37.67	26.77
Essex County.										
Newark	948	526	274	1334	645	3731	152,988	24.40	39.48	23.67
Orange	72	52	25	133	47	333	15,231	21.14	37.35	21.10
Hudson County.										
Bayonne	89	82	31	83	17	302	13,060	23.16	56.44	32.67
Harrison	54	35	23	50	20	182	6,806	26.74	44.90	34.07
Hoboken	260	147	87	317	82	916	37,721	24.28	46.62	31.33
Jersey City	948	688	322	1264	419	3666	153,513	24.01	44.38	27.94
Town of Union	75	16	12	65	23	191	8,398	22.74	47.64	26.18
Mercer County.										
Chambersburg	49	25	14	60	24	178	8,542	20.84	41.57	20.79
Trenton	165	98	46	177	118	612	34,386	17.80	42.97	25.98
Middlesex County.										
New Brunswick	92	33	34	103	82	350	18,258	19.17	35.43	26.00
Perth Amboy	50	20	15	44	17	150	6,311	23.77	46.67	31.33
Monmouth County.										
Long Branch	19	8	7	23	15	72	5,140	14.00	37.50	31.94
Morris County.										
Morristown	23	11	8	46	29	119	8,760	13.58	28.57	23.53
Passaic County.										
Passaic City	50	39	25	51	25	190	8,326	22.82	46.84	31.05
Paterson	356	231	111	445	240	1402	63,273	22.33	42.01	21.68
Salem County.										
Salem City	22	9	5	22	31	89	5,516	16.13	34.83	13.48
Union County.										
Elizabeth	187	107	77	197	147	717	32,119	22.32	41.00	26.22
Plainfield	38	30	14	38	25	153	8,913	17.17	44.44	30.72
Rahway	21	16	11	36	31	116	6,861	16.91	31.90	12.93
Warren County.										
Phillipsburg	36	34	25	42	28	155	8,058	19.24	38.71	25.81
Totals	4134	2450	1354	5123	2456	15,597	701,428	22.24	42.46	25.88

PRINCIPAL CAUSES OF DEATH.

Statistical Divisions.	Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Atlantic County.																					
Atlantic City	......	2	...	2	1	2	4	...	35	22	16	7	15	20	10	16	6	2	1	3	13
Burlington County.																					
Bordentown	2	1	...	......	....	1	......	...	1	10	6	1	4	6	4	9	8	1	2	1	4
Burlington	1	2	...	......	1	......	23	...	16	12	5	10	3	10	5	10	5	5	1	1	5
Camden County.																					
Camden City	11	50	...	10	10	8	54	...	130	66	94	109	92	51	38	80	48	16	3	8	52
Gloucester City	......	4	...	2	....	1	15	...	27	14	9	6	10	6	3	10	1	4	......	1	5
Cumberland County.																					
Bridgeton	......	3	...	1	....	3	4	3	15	18	20	10	11	13	4	8	9	3	......	2	7
Millville	2	4	...	......	4	2	9	...	21	13	21	9	7	9	4	9	9	5	2	....	4
Essex County.																					
Newark	17	84	2	21	54	21	226	13	446	392	257	340	339	246	165	271	157	91	11	40	142
Orange	......	10	...	8	13	1	16	1	31	33	21	45	16	26	12	20	11	10	5	4	13
Hudson County.																					
Bayonne	4	2	...	3	4	2	45	1	38	14	11	54	33	8	4	10	8	5	2	1	21
Harrison	8	5	...	......	2	3	25	...	19	14	15	9	22	2	6	8	5	4	3	2	7
Hoboken	8	16	...	5	5	4	76	8	165	62	56	83	80	50	33	31	40	22	6	10	37
Jersey City	34	81	...	21	23	18	380	7	456	260	228	489	337	174	109	190	176	59	13	46	160
Town of Union	1	2	...	......	1	1	5	...	40	15	12	31	20	12	3	9	8	3	......	4	3
Mercer County.																					
Chambersburg	2	2	...	2	13	1	4	1	12	15	12	21	16	9	8	9	7	3	1	5	9
Trenton	2	17	...	6	32	7	31	4	60	51	34	74	42	32	23	47	23	15	4	9	15
Middlesex County.																					
New Brunswick	2	10	...	2	3	3	11	2	56	30	29	29	28	24	16	23	12	15	3	5	14
Perth Amboy	4	......	...	4	1	1	13	...	24	14	7	12	18	5	2	11	3	1	1	....	10
Monmouth County.																					
Long Branch	......	4	...	......	....	2	3	...	14	2	2	2	4	7	1	9	3	2	1	3	1
Morris County.																					
Morristown	3	3	...	......	....	1	3	...	18	14	10	9	5	2	1	14	14	3	1	1	3
Passaic County.																					
Passaic City	1	9	...	......	2	1	27	1	18	16	10	15	22	6	6	13	7	1	2	1	10
Paterson	7	20	...	12	7	18	84	4	152	115	102	175	147	83	55	98	59	25	3	13	52
Salem County.																					
Salem City	......	2	...	......	....	......	......	...	10	10	8	7	8	5	5	8	8	5	......	1	4
Union County.																					
Elizabeth	9	7	...	2	2	2	60	3	83	45	55	68	72	43	21	44	32	17	3	6	40
Plainfield	4	2	...	11	3	......	2	...	25	8	7	18	11	12	9	9	6	3	4	1	5
Rahway	2	1	...	1	1	2	3	...	5	15	11	14	7	16	5	10	2	2	......	1	3
Warren County.																					
Phillipsburg	1	6	1	7	....	2	7	...	16	12	9	13	16	5	5	8	14	4	......	3	7
Totals	125	349	3	130	192	107	1154	43	1938	1294	1087	1600	1380	883	557	934	683	326	72	172	646

Table showing the Percentage of the Total Mortality at each Age-Period in State of New Jersey. All Counties, Exclusive of Cities, and Certain Specified Cities, and all other Cities.

	The State.	Cities.	Counties, exclusive of Cities.	Newark.	Jersey City.	Paterson.	Camden.	All other Cities.
Under one year	24.04	19.75	26.44	25.39	25.72	25.53	28.45	27.44
One to five	13.96	10.83	15.71	14.09	18.66	16.48	13.07	15.17
Five to twenty	8.75	8.88	8.68	7.34	8.74	7.92	11.12	9.25
Twenty to sixty	31.33	28.64	32.84	35.73	34.29	31.74	30.30	30.78
Sixty and over	21.24	31.04	15.75	17.27	12.18	17.12	16.50	16.57
Unknown	.68	.86	.58	.18	.41	1.21	.56	.79
Totals	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

ATLANTIC COUNTY. POPULATION, 22,356. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Absecon	7	......	1	3	5	16	567	......	......	1	......	......	......	......	......	......	4	3	1	1	......	3	......	......	......	......	......	......	1
*Atlantic City	77	20	16	68	33	214	7,942	27.20	......	3	......	2	1	2	4	......	38	22	16	7	15	20	10	16	6	2	1	3	13
Buena Vista	1	1	3	2	3	10	1,016	......	......	......	......	......	......	1	......	......	1	3	1	......	1	......	......	......	1	1	......	......	1
Egg Harbor City	4	2	1	9	4	20	1,317	......	......	1	......	......	2	......	......	1	2	4	1	1	1	1	......	1	3	......	......	......	......
Egg Harbor Township	16	5	4	17	20	62	3,919	......	1	......	......	......	1	......	3	......	6	5	4	6	1	6	1	7	4	3	......	......	5
Galloway	6	5	5	10	18	44	2,153	......	2	3	1	......	......	1	2	2	2	......	4	5	1	1	3	4	3	1 1	......	1	3
Hamilton	7	2	5	5	7	26	1,454	......	......	......	......	......	......	......	......	......	4	2	4	1	2	2	......	......	3	......	......	......	1
Hammonton	11	2	3	6	11	33	2,525	......	......	......	......	......	2	......	2	1	3	......	5	......	1	5	......	......	1	2	......	......	2
Mullica	......	......	......	2	6	8	847	......	......	......	......	......	......	......	......	......	......	......	2	......	......	1	......	......	2	1	......	......	......
Weymouth	4	......	......	1	4	9	626	......	......	......	......	......	......	......	......	......	1	......	2	1	1	......	1	1	......	......	......	......	......
Totals	133	37	38	123	111	442	22,356	15.20	3	8	1	2	6	4	11	4	61	38	40	22	23	39	15	20	23	11	1	4	26

* This and all other cities that are health resorts have an excessive death-rate by reason of temporary increase of population, which also includes a proportion of invalids above the average. Local Boards show this on their record.

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

BERGEN COUNTY. Population, 39,880. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																					
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Englewood	16	17	16	25	13	89	4,429	......	1	2	......	16	......	1	1	......	10	4	7	9	6	9	2	6	4	2	1	2	3
Franklin	10	1	7	2	12	32	2,194	......	1	1	......	......	......	1	3	......	4	3	1	3	3	2	1	3	2	......	......	......	......
Harrington	6	5	3	12	17	33	2,604	......	3	......	......	......	......	......	1	1	2	2	2	5	2	4	1	3	2	......	......	1	2
Hohokus	5	5	2	13	17	42	2,898	......	1	2	......	......	......	......	......	......	1	3	2	5	5	4	2	5	1	1	......	1	5
Lodi	18	7	8	14	11	58	4,347	......	1	1	......	......	2	1	6	......	8	4	3	3	4	5	......	4	4	1	......	......	2
Midland	3	1	5	9	17	36	1,617	......	......	1	......	......	......	......	2	......	2	3	1	6	......	2	3	3	4	1	1	......	4
New Barbadoes	26	12	9	37	29	115	4,933	......	1	8	......	......	......	4	7	1	11	10	9	7	5	10	4	12	3	4	1	2	4
Orvil	2	......	1	5	9	17	......	......	......	......	......	......	......	......	......	......	......	2	1	5	1	3	......	2	1	......	......	......	2
Palisade	5	4	3	7	8	28	2,333	......	......	2	......	......	......	......	1	......	2	1	2	2	3	2	1	5	1	......	......	2	2
Ridgefield	12	10	7	19	13	61	4,487	......	1	1	......	4	......	1	3	......	7	5	5	8	6	3	2	2	1	......	2	......	8
Ridgewood	8	......	2	6	9	25	1,776	......	1	......	......	......	......	......	1	1	2	1	2	2	1	2	2	4	1	......	......	......	2
Saddle River	6	3	1	......	4	15	1,584	......	1	......	......	......	......	......	2	1	6	1	......	......	......	1	......	......	1	......	......	......	......
Union	16	6	2	29	11	66	3,914	......	......	......	......	1	1	......	2	......	4	7	4	8	6	4	5	5	7	1	1	......	2
Washington	7	6	4	11	17	45	2,714	......	3	2	......	......	1	......	1	......	5	2	2	3	5	2	2	6	3	1	1	......	6
Totals	140	77	70	189	187	663	39,880	16.62	14	20	......	21	4	8	30	4	64	43	41	61	45	53	25	60	35	11	7	8	42

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

BURLINGTON COUNTY. Population, 57,556. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bass River	4	1	2	3	3	13	906										2	1	1	1		1	2	1	1				1
Beverly	7	7	5	13	14	46	3,356			2							8	1	2	6	3	6	3	4	4				3
Bordentown	15	3	3	33	24	78	5,657	13.32	2	1				1			1	10	6	1	4	6	4	9	8	1	2	1	4
Burlington	27	22	13	26	34	133	7,690	17.30	1	2			1		23		16	12	5	10	3	10	5	10	5	5	1	1	5
Chester	7	5	7	15	19	53	3,071			1					1	1	4		4	6	4	4	1	8	5	2		2	1
Chesterfield	2		2	9	8	21	1,453			1		1							3	2	1	1		4	2		1	1	1
Cinnaminson	6	3	3	11	9	34	2,640			3					1		6	2	2	3		4		2	3	1			1
Delran	11	3	4	6	13	37	1,937							1			4	2	1	3	7	3	1	4	1	1			
Eastampton			1	3	3	7	655			1						1			1			1		2					1
Evesham	5	6	1	10	6	28	1,556		1	2					3		4	6	1	2	2			1	2				1
Florence	8	3	1	6	12	29	1,562								3		1	1	2	5	3		3	4	3		1		
Little Egg Harbor	2	1	5	5	9	22	1,885						1				2		4	2	1	3		5	1				2
Lumberton	3	1			1	5	1,735								1		1							1					
Mansfield	3	2	1	8	10	24	1,716			4				1			3	2	1	2	1	1	1	3	4		1		
Medford	5	4	7	6	15	37	2,064							3	2		1	1	1	8	5	3	1	5	2		1		2
Mount Laurel	4	1			8	13	1,781			1							3			2	1	1		1	1	2			
New Hanover	9	2	1	7	17	36	2,235			2				5			2	1	3	4		2		8	2	2			
Northampton	21	14	12	33	31	111	6,006			4		2	3		6		7	5	10	7	4	13	1	16	5	4	1		4
Pemberton	10	2	3	17	34	67	2,944		1	2							5	3	5	9	1	4	1	12	4	3		1	1
Randolph			1		2	3	365									1				1					1				
Shamong	2	3	1	5	6	17	933										1	2	1	6	1		1						2
Southampton	4	1		9	2	16	2,363		1	1				1		1		1	2			2	1		1	1			
Springfield	10	1	2	5	7	26	1,684		1	1				1			1	3		3	2	2	1	2	2	1			
Washington				1	1	2	333						1										1						
Westampton	3		1	3	2	9	688										1		2	1	1			3					1
Willingboro		2	1	1	5	9	725									1	1					2	1	1		1			
Woodland	1	1	2			4	306					3					1												
Totals	171	87	78	243	295	880	57,556	15.29	7	28		6	6	13	40	5	75	53	57	53	44	69	28	106	57	24	8	6	30

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

CAMDEN COUNTY. Population, 76,685. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhœal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Camden City	307	141	120	327	178	1,079	52,884	20.40	11	50	......	10	10	8	58	......	130	66	94	109	92	51	38	80	48	16	3	8	52
Centre	10	4	3	9	5	31	1,723	......	......	......	......	......	......	......	......	......	7	2	2	4	3	4	1	1	2	......	......	1	......
Delaware	4	1	3	4	4	16	1,572	......	......	1	......	......	......	......	2	......	2	1	2	1	1	1	1	4	......	......	......	......	......
Gloucester City	44	24	13	42	14	137	5,966	22.96	......	4	......	2	......	1	15	......	27	14	9	6	10	6	3	10	1	4	......	1	5
Gloucester	12	8	4	27	25	77	2,542	......	1	......	......	......	1	......	2	......	8	8	11	4	1	3	2	12	8	2	1	2	3
Haddon	9	7	5	16	20	57	3,270	......	1	3	......	1	1	......	3	......	3	2	3	8	5	3	4	5	9	1	......	......	1
Stockton	25	15	11	21	16	89	4,450	......	1	5	......	1	......	......	9	......	11	2	5	6	9	1	4	6	6	1	1	1	8
Waterford	13	2	......	7	9	31	2,098	......	......	1	......	......	......	......	1	......	5	3	2	1	3	2	......	4	......	1	1	......	1
Winslow	8	7	1	9	6	31	2,180	......	......	......	......	2	......	2	4	......	4	1	5	1	2	......	......	5	2	......	......	......	2
Totals	432	209	160	462	277	1,548	76,685	20.19	14	64	......	16	12	11	94	......	197	99	133	140	126	71	53	127	76	25	6	13	72

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

CAPE MAY COUNTY. Population, 10,744. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																					
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Cape May City	8	4	4	14	13	44	1,610	......	......	......	......	1	......	2	3	......	3	1	1	2	1	3	2	10	1	1	......	......	5
Dennis	5	......	3	9	7	24	2,328	......	......	......	......	......	......	......	......	......	......	1	3	4	1	......	......	5	3	2	......	2	......
Lower	5	7	3	4	12	31	2,026	......	......	......	......	7	1	......	......	......	4	2	......	2	......	2	1	4	3	1	1	......	1
Middle	10	2	2	16	22	52	2,605	......	2	......	......	......	......	......	1	......	7	4	3	8	1	2	......	11	5	3	......	......	1
Upper	2	2	2	1	14	23	2,175	......	......	......	......	......	......	1	......	1	2	3	1	2	2	3	1	1	2	1	......	......	1
Totals	30	15	14	44	68	174	10,744	16.20	2	......	......	8	1	3	4	1	16	11	8	18	5	10	4	31	14	8	1	2	8

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

CUMBERLAND COUNTY. POPULATION, 41,982. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhœal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bridgeton	48	19	8	47	40	163	10,065	16.19	......	3	......	1	......	3	4	3	15	18	20	10	11	13	4	8	9	3	......	2	7
Commercial	4	......	1	5	3	13	2,544	......	......	1	......	......	......	......	......	......	1	2	2	1	1	3	1	......	......	......	......	......	......
Deerfield	2	......	1	2	6	11	1,632	......	......	......	......	......	......	......	......	1	......	1	1	4	......	......	2	1	......	1	......	......	......
Downe	6	......	3	6	3	18	1,560	......	......	1	......	......	......	......	......	......	5	......	1	3	......	1	1	1	1	1	2	......	......
Fairfield	2	2	......	5	2	11	1,612	......	......	1	......	......	......	......	......	......	2	3	1	1	......	......	......	1	......	1	......	......	......
Greenwich	6	3	2	7	8	26	1,267	......	......	......	......	......	......	......	......	......	5	2	1	2	1	3	2	3	2	1	......	1	1
Hopewell	3	2	3	5	7	20	1,794	......	......	1	......	......	......	......	2	......	......	1	1	2	1	1	......	2	1	......	......	......	1
Landis	32	8	8	38	26	115	7,021	......	1	1	......	2	......	1	5	......	10	9	6	6	11	12	6	7	8	4	2	2	3
Lawrence	5	3	1	11	9	29	1,728	......	......	......	......	......	......	......	1	......	2	1	7	4	2	......	......	5	3	......	1	......	......
Maurice River	10	4	2	3	14	33	2,562	......	......	......	......	1	......	......	......	1	4	3	1	5	2	4	......	3	1	1	......	......	1
Millville	30	25	15	42	34	146	8,824	16.55	2	4	......	......	4	2	9	......	21	13	21	9	7	9	4	9	9	5	2	......	4
Stoe Creek	......	1	2	3	......	6	1,073	......	......	......	......	......	......	......	1	......	......	2	1	......	1	......	1	......	......	......	......	......	......
Totals	148	67	48	174	154	591	41,982	14.08	3	12	......	4	4	6	22	5	65	55	63	47	37	46	21	40	34	17	7	5	17

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

ESSEX COUNTY. Population, 213,764. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Belleville	16	12	4	19	21	73	3,235	......	3	......	......	......	4	......	......	......	7	6	8	11	7	6	3	6	3	1	1	......	2
Bloomfield	27	14	14	23	21	99	6,592	......	......	......	......	10	......	......	4	......	4	5	6	4	11	9	8	10	7	4	1	1	3
Caldwell	5	3	1	5	14	28	3,336	......	......	2	......	......	......	......	1	......	2	1	......	3	1	5	3	1	3	1	......	1	1
Clinton	5	2	4	15	16	42	2,830	......	2	1	......	......	......	......	3	......	1	4	3	3	......	4	3	9	2	2	......	2	1
East Orange	30	15	15	34	31	126	10,328	......	1	3	......	3	3	1	14	......	13	9	6	15	8	10	4	9	4	6	1	1	......
Franklin	2	1	1	2	2	8	1,602	......	......	......	......	......	......	......	......	......	3	2	......	......	......	......	......	......	2	......	......	......	1
Livingston	2	3	3	2	10	20	1,275	......	......	......	......	......	......	1	......	......	2	1	3	2	2	......	1	4	2	......	......	......	......
Millburn	1	2	4	8	13	28	2,023	......	......	1	......	......	1	......	4	......	1	3	3	3	......	1	3	5	......	......	......	......	3
Montclair	13	9	5	12	6	45	6,327	......	1	......	......	......	......	......	8	......	5	2	......	5	7	3	4	2	3	3	......	......	......
Newark	948	526	274	1334	645	3734	152,988	24.40	17	84	2	21	54	21	226	13	446	392	257	380	339	246	165	271	157	91	11	40	142
Orange	72	52	25	133	47	332	15,231	21.14	......	10	......	8	13	1	16	1	31	35	21	45	16	26	12	20	11	10	5	4	13
South Orange	8	6	1	10	12	38	4,225	......	......	......	......	......	1	......	......	......	2	4	5	5	2	4	1	5	......	......	......	......	2
West Orange	8	4	3	14	13	42	3,812	......	......	......	......	......	2	......	1	......	4	5	3	4	2	1	3	2	3	7	......	1	2
Totals	1132	649	334	1616	851	4815	213,764	21.59	24	101	2	42	78	24	277	14	521	469	315	480	395	315	210	344	197	125	19	50	170

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

GLOUCESTER COUNTY. POPULATION, 27,603. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Clayton	8	9	8	11	9	45	2,399	......	......	1	......	1	......	......	4	......	5	3	5	1	5	1	1	3	5	1	......	......	3
Deptford	3	3	1	5	6	18	1,744	......	......	......	......	......	......	......	1	......	......	1	2	2	3	......	......	3	3	......	......	......	......
East Greenwich	9	3	......	10	15	37	1,233	......	......	......	......	......	......	2	1	1	3	2	2	2	3	5	1	4	2	......	1	......	2
Franklin	9	6	2	7	15	39	2,362	......	......	......	......	......	......	2	2	......	3	6	1	7	......	1	......	3	3	2	1	......	1
Glassboro	14	9	1	13	8	46	2,377	......	......	1	......	......	......	1	5	......	7	5	2	2	6	1	......	4	4	......	......	......	1
Greenwich	4	2	1	4	8	19	1,729	......	......	2	......	......	......	......	......	......	2	......	3	5	1	1	......	2	1	1	......	......	1
Harrison	4	3	......	7	16	30	1,637	......	......	1	......	......	......	......	1	......	5	1	2	2	......	4	2	5	2	1	......	......	2
Logan	1	1	......	7	6	15	1,653	......	......	......	......	......	......	......	......	......	......	......	2	1	......	2	......	1	3	3	......	1	......
Mantua	4	1	1	7	10	24	1,624	......	......	1	......	......	......	......	1	......	......	2	2	......	1	5	......	3	3	......	......	1	......
Monroe	10	7	3	7	7	34	1,950	......	......	1	......	......	......	......	......	......	4	2	4	2	4	1	1	1	3	4	......	......	1
South Harrison	......	1	......	5	2	8	1,091	......	......	1	......	......	......	......	......	......	......	1	2	1	1	......	......	1	1	......	......	......	......
Washington	5	2	......	3	6	16	1,266	......	......	......	......	......	......	......	......	1	1	1	......	2	1	1	1	2	1	2	......	......	......
West Deptford	6	3	......	7	6	23	1,305	......	......	1	......	1	......	......	2	......	3	2	2	......	2	1	1	1	1	......	......	......	2
Woodbury	14	4	1	18	13	50	3,278	......	......	......	......	......	......	......	1	1	6	5	5	4	4	3	2	5	2	......	......	......	4
Woolwich	8	3	4	9	15	39	2,046	......	......	......	......	......	1	......	3	......	3	2	2	8	......	6	1	3	2	3	......	......	1
Totals	99	57	22	120	142	443	27,603	16.00	......	9	......	2	1	5	21	3	42	33	36	39	31	32	10	44	36	17	2	2	18

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

HUDSON COUNTY. Population, 240,342. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bayonne	89	82	31	63	17	203	13,080	23.16	4	2	......	3	4	2	45	1	38	14	11	54	33	8	4	10	8	5	2	1	21
Guttenberg	10	6	3	9	5	33	1,615	....	1	1	......	1	......	1	......	......	5	4	......	3	4	2	1	......	2	......	......	......	2
Harrison	54	35	23	60	20	182	6,806	26.74	8	5	......	......	2	3	25	......	19	14	15	9	22	2	6	8	5	4	3	2	7
Hoboken	280	147	87	317	82	916	37,721	24.28	8	16	......	5	5	4	76	8	165	62	56	83	80	50	33	31	40	22	6	10	37
Jersey City	948	668	322	1264	449	3,686	153,513	24.01	34	81	......	21	33	18	380	7	456	260	228	489	337	174	109	190	176	59	13	36	160
Kearny	20	4	8	28	9	70	3,338	....	4	1	......	......	2	......	2	......	5	5	6	13	3	2	......	6	2	......	......	2	7
North Bergen	33	25	14	81	48	201	5,459	....	2	3	1	......	......	1	5	2	16	18	14	16	13	15	15	26	14	5	......	2	6
Town of Union	75	16	12	65	23	191	8,398	22.74	1	2	......	......	1	1	3	......	40	15	13	31	20	12	2	9	8	3	......	4	3
Union	7	6	6	11	2	32	1,761	....	......	2	......	......	1	......	2	......	4	3	3	3	5	3	......	2	......	2	......	......	1
Weehawken	14	6	6	13	4	44	1,469	....	......	2	......	......	1	......	1	......	2	3	5	3	9	1	1	5	......	1	......	......	5
West Hoboken	43	25	9	38	27	141	7,162	....	1	3	......	......	3	1	6	4	28	11	7	15	17	13	5	7	5	3	......	......	1
Totals	1572	1040	531	1939	666	5,799	240,342	24.13	63	116	1	30	52	31	547	22	781	408	357	719	543	283	177	294	260	104	24	57	250

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

HUNTERDON COUNTY. Population, 37,420. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Alexandria	2	...	......	4	7	13	1,335	......	......	......	......	......	......	......	......	......	1	......	......	1	1	3	1	2	2	......	......	......	1
Bethlehem	9	9	3	12	10	43	2,780	......	......	1	......	1	2	......	5	......	4	4	3	2	2	2	......	9	1	2	......	1	1
Clinton	5	3	2	8	9	28	2,900	......	1	......	......	2	......	......	2	......	3	4	2	1	1	4	......	3	1	......	......	1	1
Delaware	4	1	......	6	17	28	3,092	......	......	......	......	......	......	......	......	......	2	2	3	2	......	3	1	5	1	......	1	3	......
East Amwell	2	......	......	8	15	25	1,549	......	1	1	......	......	......	......	......	......	......	2	1	1	......	3	4	8	2	......	......	......	......
Franklin	2	......	1	2	3	9	1,367	......	......	1	......	......	......	......	......	......	2	1	......	......	......	......	......	2	1	......	......	......	......
Frenchtown	1	1	......	4	9	15	1,066	......	......	......	......	......	......	......	1	......	1	1	1	4	......	......	......	3	1	......	1	......	......
High Bridge	3	2	1	3	5	14	2,024	......	......	......	......	......	......	......	1	......	1	......	......	......	1	4	......	2	......	2	......	......	1
Holland	2	3	1	6	7	20	1,867	......	......	......	......	1	......	......	1	......	1	2	1	3	......	......	2	3	3	......	......	1	......
Kingwood	4	......	1	5	14	21	1,482	......	......	1	......	......	......	......	......	......	1	......	2	1	......	3	1	2	3	3	......	1	3
Lambertville	12	5	5	19	21	63	4,067	......	2	1	......	......	......	......	3	......	4	7	6	7	6	2	2	8	5	3	......	......	3
Lebanon	9	11	9	10	13	52	2,816	......	1	1	......	8	2	......	5	......	4	2	4	4	1	5	3	4	1	1	......	......	3
Raritan	10	2	5	16	24	57	3,978	......	......	......	......	1	2	......	......	......	7	5	8	3	1	5	1	9	3	3	......	......	4
Readington	7	2	2	9	18	38	2,910	......	1	1	......	1	......	......	1	......	1	2	3	3	1	4	1	9	4	1	......	......	1
Tewksbury	5	......	2	2	7	16	2,081	......	......	......	......	......	......	......	......	......	2	1	1	2	1	2	1	2	1	1	......	1	1
Union	2	1	2	4	7	16	1,196	......	......	......	......	......	......	......	......	......	1	2	3	......	2	2	1	......	2	1	......	......	1
West Amwell	3	......	1	7	9	20	960	......	......	......	......	......	......	......	......	......	1	1	2	2	1	4	......	2	1	2	1	1	......
Totals	82	40	35	125	195	481	37,420	12.85	6	7	......	14	6	......	19	......	36	36	40	38	18	45	18	73	32	19	3	8	20

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

MERCER COUNTY. Population, 66,785. Statistical Divisions.	Deaths at all ages. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	Principal causes of death. Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Chambersburg	49	25	14	60	28	178	6,542	20.84	2	2	......	2	13	1	4	1	12	15	12	21	16	9	8	9	7	3	1	5	9
East Windsor	5	7	1	14	10	39	2,568	......	......	......	......	......	1	......	1	2	2	3	3	4	5	[illegible]	1	5	3	3	......	1	......
Ewing	9	1	7	37	26	81	2,489	......	......	......	......	2	......	......	......	2	4	6	7	3	1	3	2	32	3	1	......	1	7
Hamilton	11	7	7	16	21	62	3,420	......	3	1	......	......	1	......	1	......	4	3	5	5	3	5	1	5	5	3	......	1	8
Hopewell	7	1	5	18	29	60	4,367	......	......	2	......	1	......	......	......	......	2	5	6	11	2	4	1	11	5	1	......	1	3
Lawrence	3	2	1	10	11	27	1,589	......	1	......	......	1	......	......	......	......	......	......	2	1	2	2	......	10	......	1	1	......	4
Millham	22	11	3	15	5	57	2,338	......	......	1	......	......	6	1	......	......	7	3	1	9	9	5	2	1	2	1	......	......	3
Princeton	8	7	9	17	25	66	4,577	......	......	1	......	......	1	......	4	......	6	8	4	6	3	5	5	2	7	2	1	1	1
Trenton	165	96	46	177	118	612	34,386	17.80	2	17	......	6	32	7	31	4	60	51	34	74	42	32	23	47	25	15	4	9	15
Washington	3	......	......	4	7	14	1,196	......	......	......	......	......	......	......	......	......	2	3	1	......	......	......	1	2	......	3	1	......	......
West Windsor	1	3	1	2	12	19	1,313	......	......	......	......	......	......	......	......	......	1	2	2	4	......	4	......	1	1	1	......	......	1
Totals	284	162	94	370	202	1,215	66,785	18.19	8	24	......	12	34	9	41	9	100	99	77	137	83	71	44	125	58	34	8	19	51

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

MIDDLESEX COUNTY. Population, 56,180. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhœal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Cranbury	2	......	......	8	14	25	1,569	......	2	......	......	......	......	......	......	......	1	6	......	3	......	1	2	2	5	......	......	......	2
East Brunswick	5	3	3	12	16	40	3,697	......	1	5	......	......	......	......	1	......	3	2	3	5	2	4	3	4	3	......	......	......	......
Madison	......	3	2	4	4	13	1,319	......	......	......	......	......	......	......	......	......	2	1	4	2	......	......	1	......	1	......	......	......	......
Monroe	6	7	4	5	11	33	3,199	......	......	......	......	......	......	1	3	......	3	3	4	3	3	2	1	3	1	1	......	......	2
New Brunswick	92	82	34	103	82	350	18,258	19.17	2	10	......	2	3	3	11	2	58	30	29	29	28	24	16	23	12	15	3	5	14
North Brunswick	2	......	2	6	8	20	1,272	......	......	......	......	......	......	......	......	......	......	3	1	2	......	......	1	2	2	1	......	2	2
Perth Amboy	50	20	15	44	17	150	6,311	23.77	4	......	......	4	1	1	13	......	24	14	7	12	18	5	2	11	3	1	1	......	10
Piscataway	8	6	3	6	11	34	3,155	......	......	......	......	......	1	1	......	......	4	3	......	4	3	1	4	2	3	......	1	......	1
Raritan	6	3	6	15	14	45	3,646	......	......	1	......	......	2	......	2	......	2	1	3	2	2	4	6	6	1	......	1	2	5
Sayreville	5	3	......	2	2	12	2,549	......	1	......	......	1	......	......	2	......	1	......	......	1	3	......	......	......	......	......	......	......	1
South Amboy	23	9	2	16	10	60	4 054	......	......	......	......	......	2	......	4	......	9	3	5	5	8	2	1	6	4	1	......	1	2
South Brunswick	4	2	1	11	19	37	2,714	......	1	......	......	......	......	......	......	1	3	3	4	5	2	4	1	2	1	1	......	1	3
Woodbridge	13	10	7	18	22	70	4,227	......	......	......	......	......	......	4	5	......	5	7	6	9	5	6	......	6	2	......	......	......	8
Totals	216	98	79	250	230	889	56,180	15.82	11	16	......	7	9	10	41	3	115	76	66	82	74	53	38	67	38	20	6	11	43

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

MONMOUTH COUNTY. Population, 62,324. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Atlantic	4	1	1	6	7	19	1,656	......	1	......	......	1	......	......	1	......	......	3	2	1	1	2	......	1	2	1	......	......	......
Eatontown	10	3	5	4	13	35	2,612	......	......	......	......	......	......	......	3	......	2	5	2	8	1	2	1	2	2	......	......	1	......
Freehold	26	11	5	15	27	86	4,494	......	3	1	......	......	......	8	6	......	5	5	3	9	4	5	2	7	5	2	1	1	1
Holmdel	2	......	2	5	6	15	1,840	......	......	......	......	......	......	......	1	......	......	2	3	3	1	1	......	......	1	......	......	......	2
Howell	6	4	3	15	14	42	3,308	......	......	......	......	......	......	......	......	......	6	7	2	3	3	3	2	5	7	1	......	1	......
Long Branch	19	8	7	23	15	72	5,140	14.00	......	4	......	......	......	2	3	......	14	2	2	2	4	7	1	9	3	2	1	3	1
Manalapan	6	1	......	7	13	27	2,143	......	......	......	......	......	......	2	......	......	......	3	......	4	......	2	......	4	4	1	......	......	2
Marlboro	4	5	5	9	12	35	2,049	......	1	......	......	......	......	1	6	......	2	6	3	1	1	2	......	2	7	......	......	......	1
Matawan	18	14	7	17	15	71	2,726	......	1	......	......	......	1	......	5	2	12	3	7	5	3	5	4	3	10	2	......	1	......
Middletown	15	9	11	22	23	81	5,802	......	......	2	......	......	......	......	5	......	6	7	7	15	4	7	1	8	2	3	1	......	1
Millstone	10	4	4	4	5	28	1,917	......	1	......	......	......	......	4	3	......	3	......	3	2	2	2	1	......	2	......	......	......	1
Neptune	23	16	17	42	23	122	6,421	......	1	1	......	......	3	......	17	......	14	5	11	6	5	4	3	14	12	7	3	1	5
Ocean	12	5	7	16	9	49	2,400	......	......	......	......	1	......	......	5	......	2	......	7	5	......	3	2	4	......	1	......	......	12
Raritan	25	7	4	25	14	75	4,239	......	......	3	......	......	......	......	3	......	14	5	7	9	6	1	1	5	3	4	......	1	3
Shrewsbury	23	18	16	43	31	136	7,556	......	1	3	......	......	2	......	19	......	15	8	17	8	4	6	2	10	9	3	......	2	9
Upper Freehold	10	5	6	16	20	57	3,130	......	......	2	......	......	2	2	......	......	6	4	4	6	1	5	3	4	8	2	......	2	2
Wall	18	8	6	19	23	75	4,820	......	1	1	......	......	......	1	5	......	9	3	7	6	4	9	3	6	6	......	2	1	6
Totals	236	119	106	288	270	1,025	62,324	16.45	10	18	......	2	8	20	82	2	113	68	87	93	44	66	26	84	83	29	8	14	46

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

MORRIS COUNTY. Population, 50,675. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																					
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Boonton	6	3	4	26	19	69	2,732	......	2	1	......	3	......	......	......	......	3	4	6	4	......	2	2	10	8	3	1	2	5
Chatham	13	6	8	20	18	65	4,291	......	......	3	......	......	......	1	3	......	6	8	4	5	4	7	3	5	1	4	2	......	1
Chester	7	6	5	4	8	30	2,510	......	......	......	......	......	2	1	3	......	1	3	2	5	2	2	1	2	1	......	......	1	......
Hanover	8	7	5	58	46	124	4,459	......	......	1	......	1	......	......	3	......	1	3	7	7	6	6	7	61	6	4	......	......	......
Jefferson	2	5	3	9	7	27	1,559	......	......	1	......	......	......	......	......	......	2	1	2	10	......	3	2	3	2	......	......	......	1
Mendham	3	......	1	8	14	24	1,431	......	......	......	......	......	......	......	......	......	......	1	5	3	......	5	......	......	3	2	......	......	......
Montville	3	......	......	2	6	11	1,225	......	......	......	......	......	......	......	......	......	......	......	......	......	1	1	1	2	2	2	......	......	......
Morristown	23	11	8	46	29	119	8,760	13.58	3	3	......	......	......	1	3	......	18	14	10	9	5	2	1	14	14	3	1	1	3
Mount Olive	3	1	1	6	5	16	2,005	......	......	1	......	......	......	......	1	......	1	1	1	......	......	1	......	1	1	......	......	1	2
Passaic	3	2	5	5	10	25	1,716	......	......	2	......	......	......	......	......	......	3	4	1	3	2	2	2	3	1	......	......	......	......
Pequannock	6	3	3	5	9	26	2,625	......	......	......	......	......	......	......	3	......	1	1	2	......	6	1	2	4	1	......	......	......	3
Randolph	30	11	8	31	25	106	7,045	......	1	1	......	......	1	1	6	2	6	1	5	18	8	12	3	10	8	1	2	......	4
Rockaway	23	20	8	38	18	107	5,573	......	1	2	......	2	6	1	2	3	9	8	12	12	5	3	2	6	10	1	......	4	10
Roxbury	7	5	9	26	10	57	2,184	......	......	......	......	1	2	......	4	1	......	1	3	3	3	4	1	5	2	......	......	......	22
Washington	5	3	1	5	6	20	2,560	......	......	1	......	......	......	......	1	......	2	2	......	3	1	3	......	1	1	......	......	1	1
Totals	143	83	69	287	230	816	50,675	16.10	7	16	......	7	11	5	29	6	53	53	60	85	43	54	27	137	61	20	6	10	51

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

OCEAN COUNTY. Population, 15,586. Statistical Divisions.	Deaths at all ages: Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.
Berkeley	4	......	......	4	2	10	714	......
Brick	9	5	5	19	16	57	3,974	......
Dover	6	4	5	16	5	36	2,594	......
Eaglewood	1	......	......	3	5	9	661	......
Jackson	3	4	2	6	5	20	1,763	......
Lacey	......	3	4	4	1	12	746	......
Manchester	4	7	1	4	2	19	1,098	......
Ocean	2	......	2	3	2	9	341	......
Plumstead	5	......	......	9	9	23	1,546	......
Stafford	......	......	1	2	2	5	1,026	......
Union	1	1	......	6	3	11	1,083	......
Totals	35	24	20	76	52	211	15,586	13.54

OCEAN COUNTY. Statistical Divisions.	Principal causes of death: Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhœal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Berkeley	......	1	......	......	......	......	......	......	2	2	......	......	1	2	......	1	......	......	......	......	......
Brick	1	4	......	......	......	......	2	......	4	5	4	6	2	6	1	7	6	......	1	3	3
Dover	......	5	......	......	......	......	1	......	3	5	2	2	3	1	1	3	2	1	......	1	......
Eaglewood	......	......	......	......	......	......	......	......	......	2	......	1	......	......	2	2	......	......	......	......	1
Jackson	1	......	......	......	......	......	......	1	4	2	1	3	......	......	......	2	4	1	......	......	......
Lacey	......	......	......	......	4	......	......	......	......	1	......	......	2	......	1	......	1	......	......	1	1
Manchester	......	......	......	......	......	......	7	......	2	1	2	1	2	1	......	1	......	......	......	......	1
Ocean	......	......	......	......	......	......	......	......	......	2	......	......	1	1	1	......	1	......	......	......	1
Plumstead	1	......	......	......	......	......	1	......	2	2	5	1	1	2	1	3	......	2	......	1	......
Stafford	......	......	......	......	......	......	......	......	......	1	2	......	......	......	......	2	......	......	......	......	......
Union	......	......	......	......	......	......	......	......	1	1	3	......	......	1	......	1	2	......	......	......	1
Totals	3	10	......	......	4	......	11	1	18	24	20	12	12	14	7	22	16	4	1	6	8

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

PASSAIC COUNTY. POPULATION, 83,374. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhœal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Acquackanonk	3	2	3	7	2	17	2,038	......	......	......	......	......	......	......	3	......	1	2	1	2	......	1	......	......	3	......	......	1	1
Little Falls	9	4	1	13	2	29	1,701	......	2	......	......	1	2	......	......	......	4	1	1	3	......	2	......	3	3	......	......	......	......
Manchester	6	......	1	2	7	16	1,639	......	......	......	......	......	......	......	......	......	......	......	......	2	1	3	2	......	1	3	......	......	......
Passaic City	50	39	25	51	25	190	8,326	22.83	1	9	......	......	2	1	27	1	18	16	10	16	22	6	6	13	7	1	2	1	10
Paterson	358	231	111	445	240	1,402	63,273	22.83	7	20	......	12	7	18	84	4	152	115	102	175	147	83	55	98	59	25	3	13	52
Pompton	8	3	4	10	6	32	2,109	......	1	......	......	4	......	......	1	......	2	3	2	5	1	4	......	3	2	......	......	......	2
Wayne	2	3	2	7	2	16	1,866	......	......	......	......	......	......	......	......	......	2	......	1	2	4	......	......	2	1	......	......	......	4
West Milford	5	4	3	5	12	29	2,422	......	......	1	......	......	......	1	......	......	......	2	2	5	1	2	2	5	......	......	......	......	2
Totals	441	286	150	540	296	1,731	83,374	20.76	11	30	......	17	11	20	115	5	179	139	119	210	176	101	65	124	76	29	5	15	71

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

SALEM COUNTY. POPULATION, 25,373. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhœal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Alloway	6	...	1	5	9	21	1,749	...	...	...	...	...	...	...	2	...	2	...	1	2	1	2	1	1	3	2	1	...	1
Elsinboro	2	...	1	...	1	5	671	...	...	...	...	...	...	...	...	...	...	...	1	...	1	1	...	1	...	...	...	...	...
Lower Alloways Creek	3	...	2	4	5	14	1,266	...	...	1	...	...	...	...	...	1	1	...	...	2	...	1	...	1	1	...	1	...	2
Lower Penns Neck	4	1	5	...	3	13	1,406	...	...	...	...	...	...	...	4	...	1	...	...	4	1	...	...	...	1	...	...	...	...
Mannington	6	5	4	9	7	33	2,161	...	...	2	...	...	...	...	1	...	6	2	4	5	2	2	2	5	...	...	...	...	...
Oldmans	...	1	6	3	2	10	1,463	...	...	1	...	...	...	...	1	...	1	1	3	1	...	...	...	...	1	...	1	...	...
Pilesgrove	15	8	3	12	27	67	3,397	...	1	1	...	...	...	...	...	1	11	8	8	5	3	4	...	11	1	2	1	...	...
Pittsgrove	4	2	1	5	14	27	2,135	...	...	1	...	...	...	...	...	...	2	1	3	2	1	2	3	2	2	...	...	...	1
Quinton	5	1	...	3	...	9	1,460	...	...	...	...	...	...	...	...	...	5	1	1	...	...	1	...	1	...	...	...	...	...
Salem City	22	9	5	22	31	89	5,516	16.13	...	2	...	...	...	...	...	...	10	10	8	7	3	5	5	8	8	5	...	1	4
Upper Penns Neck	6	2	3	8	10	31	2,216	...	...	2	...	...	...	...	4	...	2	2	4	3	2	4	1	2	2	1	...	...	1
Upper Pittsgrove	4	1	3	7	6	21	1,932	...	...	...	...	...	...	...	...	...	1	3	2	1	2	1	1	4	...	...	...	2	1
Totals	77	30	32	78	115	340	25,373	13.40	1	10	...	...	...	...	12	2	42	28	35	31	16	23	13	36	19	10	4	3	10

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

SOMERSET COUNTY. Population, 27,425. Statistical Divisions.	DEATHS AT ALL AGES. Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.	Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH. Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhœal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Bedminster	1	2	4	8	11	26	1,769	......	......	......	......	1	1	......	......	......	4	1	3	3	1	......	1	3	5	......	......	......	1
Bernards	1	3	6	14	15	40	2,504	......	......	......	......	......	......	......	......	......	......	1	7	8	2	1	4	7	4	1	......	2	1
Branchburg	......	......	3	3	13	19	1,177	......	......	......	......	......	2	......	......	......	......	......	......	1	1	1	3	5	1	......	......	......	3
Bridgewater	28	27	20	37	45	159	8,454	......	1	2	......	22	3	1	15	......	10	7	11	8	7	9	8	19	10	5	......	1	4
Franklin	10	1	4	13	24	52	3,720	......	1	......	......	......	......	......	1	......	3	1	7	5	......	4	4	5	2	1	......	......	6
Hillsborough	5	4	4	11	20	45	3,151	......	1	1	......	......	2	......	......	1	5	2	3	6	2	2	2	4	2	2	......	......	4
Montgomery	3	......	1	7	18	29	1,800	......	......	......	......	......	......	......	......	......	......	3	4	3	1	4	......	6	2	1	......	......	1
North Plainfield	10	2	4	14	17	48	3,728	......	......	2	......	......	1	......	......	1	4	4	6	5	......	6	2	7	5	......	1	......	......
Warren	5	2	......	4	6	18	1,122	......	......	......	......	......	......	......	1	......	1	1	4	4	2	3	......	......	......	1	......	......	......
Totals	63	41	46	111	169	436	27,425	15.90	3	5	......	23	9	1	17	2	27	20	45	43	16	30	24	56	31	11	1	3	20

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

SUSSEX COUNTY. POPULATION, 22,401. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Andover	1	1	3	6	8	19	1,014	......	......	......	......	......	......	......	......	......	......	3	2	2	1	5	......	2	2	1	......	......	......
Byram	3	3	1	3	1	11	1,242	......	......	......	......	......	1	......	......	......	1	1	1	2	......	2	......	......	......	......	......	......	1
Frankford	6	2	......	7	9	26	1,495	......	......	......	......	......	......	......	......	......	4	......	4	2	2	4	......	2	2	1	......	......	......
Greene	2	2	......	4	3	11	704	......	......	......	......	......	......	......	......	......	2	2	......	1	1	......	......	3	1	......	......	1	......
Hampton	2	1	2	7	2	15	938	......	......	1	......	......	......	......	......	1	1	1	2	......	1	1	......	2	1	......	......	1	......
Hardyston	7	6	3	5	9	31	2,500	......	3	......	......	2	......	1	......	......	2	2	1	6	......	1	......	3	2	2	......	......	2
Lafayette	2	1	1	5	7	16	816	......	......	......	......	......	......	......	......	......	......	1	2	3	......	3	1	2	......	......	......	......	......
Montague	3	......	1	5	6	15	900	......	......	......	......	......	......	......	1	......	1	......	3	......	......	1	2	2	1	......	......	......	......
Newton	4	3	1	8	6	22	2,648	......	......	1	......	......	1	......	1	......	5	3	2	1	1	1	......	3	......	2	......	......	1
Sandyston	3	3	......	3	11	21	1,092	......	......	......	......	......	......	......	......	......	1	3	1	6	......	1	1	3	2	2	......	......	......
Sparta	1	2	1	6	9	19	1,901	......	......	......	......	......	......	......	......	......	2	1	2	4	......	3	......	4	1	......	......	......	1
Stillwater	4	......	......	4	11	19	1,366	......	......	......	......	......	......	......	......	1	......	1	......	6	1	1	......	2	3	1	......	1	......
Vernon	2	2	1	4	6	15	1,655	......	......	......	......	......	......	......	......	......	2	4	......	4	......	1	1	2	......	......	......	......	......
Walpack	......	1	......	1	2	4	553	......	......	......	......	......	......	......	......	......	......	......	......	2	......	1	......	......	......	......	......	......	......
Wantage	7	4	......	15	24	52	3,377	......	1	1	......	......	......	1	......	......	3	3	1	10	1	6	1	11	3	1	......	2	1
Totals	47	31	14	83	114	296	22,401	13.21	4	3	......	2	2	2	2	3	24	25	21	49	8	31	6	42	18	10	......	5	6

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

UNION COUNTY. POPULATION, 61,839. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																					
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined.			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhœal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Clark	2	1	......	2	1	6	363	......	......	......	......	......	......	......	......	......	......	......	1	......	1	......	1	......	1	......	......	......	1
Cranford	......	......	......	1	1	2	1,251	......	......	......	......	......	......	......	......	......	......	......	......	1	......	......	......	1	......	......	......	......	......
Elizabeth	187	107	77	197	147	717	32,119	22.32	9	7	......	2	2	2	80	3	83	45	55	68	72	63	21	44	32	17	3	6	40
Fanwood	4	1	......	3	4	12	1,210	......	1	......	......	......	......	......	......	......	1	1	......	1	......	1	......	2	......	......	......	......	2
Linden	4	2	1	11	13	31	1,971	......	1	1	......	......	......	......	2	......	2	1	4	5	1	4	1	2	......	1	......	1	3
New Providence	1	2	3	1	4	11	824	......	......	......	......	2	......	......	1	......	1	......	1	1	1	1	......	1	......	1	......	......	......
Plainfield	35	20	14	36	25	153	8,913	17.17	4	2	......	11	3	......	2	......	25	8	7	18	11	12	9	9	6	3	4	1	5
Rahway	21	16	11	36	31	116	6,861	16.91	2	1	......	1	1	2	3	......	5	15	11	14	7	16	5	10	2	2	......	1	3
Springfield	3	4	4	5	5	21	847	......	......	1	......	......	1	1	......	......	2	......	3	1	1	......	1	3	1	3	2	......	1
Summit	6	3	3	16	15	43	2,539	......	2	......	......	......	......	......	1	......	1	7	4	8	3	4	2	3	1	......	......	1	1
Union	4	1	3	8	12	28	2,589	......	1	1	......	......	1	......	2	......	3	2	1	1	......	3	1	4	1	......	......	2	2
Westfield	8	5	7	20	9	50	2,352	......	......	4	......	......	2	......	2	......	4	5	5	3	2	3	3	5	......	4	1	3	1
Totals	278	172	123	336	267	1,190	61,839	19.24	20	17	......	16	10	5	93	3	127	84	92	121	99	87	44	84	44	31	10	15	59

Return of Deaths from all Causes and Certain Specified Diseases, in the Statistical Divisions of the State of New Jersey, for the Year ending June 30th, 1887.

WARREN COUNTY. Population, 37,737. Statistical Divisions.	DEATHS AT ALL AGES.						Population, census of 1885.	Death-rate per 1,000.	PRINCIPAL CAUSES OF DEATH.																				
	Under one year.	One to five.	Five to twenty.	Twenty to sixty.	Over sixty.	Total, including undefined			Remittent fever, &c.	Typhoid fever.	Small-pox.	Scarlet fever.	Measles.	Whooping-cough.	Croup and diphtheria.	Erysipelas.	Diarrhoeal diseases.	Consumption—male.	Consumption—female.	Acute lung diseases.	Brain and nervous diseases of children.	Diseases of heart and circulation.	Urinary diseases.	Adult brain and spinal diseases.	Digestive and intestinal diseases.	Cancer.	Acute rheumatism.	Puerperal.	Accident.
Allamuchy			1		2	5	787								3					1			1						
Belvidere		4	2	4	10	22	1,814		1			1		1	3			1	1	6		2		1		3			
Blairstown	3	2	3	6	7	21	1,590							1				3	2	2	3	1		4	1	1			
Franklin	2	5	2	6	5	20	1,382					1	1		1		4	1	1		2		1	3	1			1	3
Frelinghuysen				4	3	7	964												1			3			1	1			1
Greenwich	1	2	2	3	7	15	920					1				1	1	1		2	1	2		4	1				1
Hackettstown	3	2		10	14	29	2,645										1	3	4	2	3	4	1	3	2		1	1	2
Hardwick		1		2	5	8	520								1			2			2		1						
Harmony	3	1	4	7	4	18	1,256						1				3	3	2	2	3		2	1	1				1
Hope	2	4		7	6	20	1,548								1	1	3	1	1	5				3					1
Independence			1	3	4	8	1,134											1	1	1		2		2	1				
Knowlton	4	1		7	9	21	1,456						1				1	3	1	3	1	2		2	1	2			
Lopatcong	5	6	2	8	9	30	1,725					1	1		1		2	5	2	3	2	2		3	1		1	1	2
Mansfield	5	3	3	3	12	25	1,600					6					1		1		1	5	1	5	2				1
Oxford	16	10	7	19	15	71	4,352		1			4	2		2	1	4	7	2	5	8	7	3	6	4	1			4
Pahaquarry			1	1		2	351					1											1						
Phillipsburg	36	24	25	42	28	155	8,058	19.24	1	6	1	7		2	7		16	12	9	12	16	5	5	6	11	4		3	7
Pohatcong	3	4	2	7	10	26	1,567					1	2				1		1	2	2	1		2	3	2	2	1	3
Washington	8	3	4	9	16	40	4,038					1					2	2	2	3	5	2	2	5	1	1	1		1
Totals	90	72	59	150	166	546	37,737	14.47	3	6	1	24	8	4	19	3	38	45	31	49	48	38	18	51	34	15	5	7	27

SYNOPSIS OF VITAL RETURNS AND COMMENTS ON SPECIAL DISEASES.

The records for the statistical year ending June 30th, 1887, as shown by the accompanying tables, give an aggregate of 15,416 marriages, 27,340 births and 24,331 deaths, of which number as to marriages 4,332 are recognized as relating to couples who came to this State to be married.

The following outline presents the comparative numbers for several years:

Average for five years ending June 30th, 1883:

Marriages	8,539
Births	24,281
Deaths	21,981

Number in the year ending June 30th, 1884:

Marriages	8,968
Births	25,263
Deaths	21,716

In the year ending June 30th, 1885, to be reckoned on an increased population of 146,917:

Marriages	8,989
Births	24,077
Deaths	23,807

Year ending June 30th, 1886:

Marriages	12,351
Births	25,497
Deaths	22,734

Year ending June 30th, 1887:

Marriages	15,416
Births	27,340
Deaths	24,331

Population by the census of 1885:

Cities of over 5,000 inhabitants	701,428
Rest of State	576,605
Total	1,278,033

ESTIMATION OF POPULATION.

Some questions always arise as to the modes of reckoning increase of population in our American cities and States. Abroad there is little occasion to consider the effects of immigration. Here it so varies with localities, and especially in cities, that no general law of sufficiently definite application can be announced. As we have a quinquennial census, we have an advantage over Great Britain, and most of European States, and do not so much need an estimated population.

Where estimates are made, the chief bases have been as follows: First, a study of the ratio of increase between each period of census, and an especial noting of the rate of increase of the most recent decennial or quinquennial returns. Second, a counting of the number of new houses and an estimate of the increase of the number of families assumed to average five members each. If the kind of houses is also tabulated, this reckoning is made more correct. Considering it fundamental to have a correct quinquennial census, and to have the number of persons, the number of houses and the number of families in each locality, the Superintendent of Vital Statistics early placed himself in conference with the Department of State on this subject. The response given, both by the Secretary of State and the Legislature, favored a bill that secured a census the most satisfactory ever taken in this State, and probably more accurate than that of any other State. As this census comes midway in the quinquennial tables of those years from 1883 to 1888, and as the U. S. census came also intermediate in our first quinquennial tables, death-rates calculated for either of these periods on this basis are more approximate than any of the English death-rates calculated upon estimated populations. After full consideration, we believed it to be advisable for the State Bureau not to attempt intermediate estimated populations for each locality, leaving the localities themselves to show any diminished death-rate on a reckoning of their present population. As we have reviewed the tables and heard in some cases the overestimates of

population used to minimize the death-rate, we are satisfied that our quinquennial and decennial tables will not be found to overstate the *pro rata* of deaths. Local officers are more likely to be correct in the estimated populations of any one year, although it would be well for them to state the exact basis of the estimate, also to remember that there will always be a few deaths, especially of very young children, that escape record. Also that owing to the great flight of city population from cities a part of the year, some deaths that should be credited at home are recorded elsewhere.

AGE AT DEATH.

Next in importance to the number of deaths and in some respects of even greater significance, is the age at which death occurs. In the next report we will have occasion to trace these comparisons through many years. For the present year we find that of the 24,331 deaths occurring, 5,849 were under one year of age, 3,396 were between one and five years of age, and 2,130 more did not reach the age of twenty, while 155 are undefined. Of those under one year, 1,714 died under one month. In addition, the still-birth return, which is always imperfect, would add 1,571.

Thus, at the lowest statement, 11,375 children did not reach adult life. If every family loses one-half of the children born into it, does not this present an aggregate of sorrow, of suffering and of loss of life to the State which ought to make the effort to preserve child-life more persistent? As all of the families did not lose at this rate some must have lost at a much greater rate. How artificial many of these deaths are is shown by the fact that the families in Hunterdon county (8,571) lost only 157 children under twenty years, while the 48,135 families in Hudson county lost 3,133, and this in a single year.

If the deaths in families in Hunterdon county had been in proportion to the deaths in families in Hudson county, 558 children would have been lost instead of 157 children. In other words, had Hunterdon county, instead of its usual experience, had the usual experience of Hudson county, the contrast with the ordinary mortality in Hunterdon would have been so great that the whole county would have recognized its people as suffering from a fearful scourge, and as deaths always stand for a large amount of sickness in those that recover, it would have been recognized that a wide-spread calamity

had fallen upon the county. Yet our compact city populations and thickly-settled suburbs get so used to this sort of thing as to regard it as a necessity. Let those who, like Malthus, are troubled with fears of overpopulation, and who desire to limit increase in their own families, move to the least favored sections, but let all others either live in the best country districts or else see to it that their whole influence is upon the side of municipal sanitary reform.

It is to be remembered, too, that we are now only drawing the contrast of the deaths of those under twenty years of age. The number who died in Hunterdon county older than twenty years was 320, while in Hudson county it was 2,695. Thus, among adults at the same rate, there would have been 480 deaths. The excess is enough here, yet not so great, because so much of the material for death had departed in early life.

We do not single out Hunterdon county on the one hand or Hudson on the other, because they are so very much different from some other counties, but only because they show a sharp contrast which is to a large degree apparent in other counties, and especially as between those which have not large cities in them. As the population of the counties with cities increases faster than those who have none, some deduction is to be made for the difference of relative increase.

FEEDING OF CHILDREN.

When we consider that a large percentage of all persons born die under five years of age, and also that the mortality between five and fifteen is not inconsiderable, it well becomes us to study closely the causes of this early mortality. However natural death may be in advanced age, it is unnatural in childhood. So true is this, that the rate of mortality among the young is a more accurate test of the effect of preventable disease than is the general death-rate. When we come to analyze the causes of this mortality we find as the chief, bad heredity, bad food, bad drink and bad air. The heredity is difficult of remedy, but yet it is found that such is the tendency, even of inherited diseases, to limitation, that many weakly born, if placed under the best hygienic conditions, are able to surmount inherited tendencies. The evils arising from wrong food and drink are especially prominent. These find their registry not merely in the various forms of bowel trouble, but also in the large class of nervous diseases which result from intestinal irritation.

For infants there have been many devices of food and many attempts to imitate the mother's milk. None of them have equaled nature's supply. For the first half year, at least, as a rule, sole reliance is to be placed upon the mother's milk.

Where other food has to be used it should be fresh cow's milk mixed with an equal quantity of warm water, and some salt and a little sugar should be added. No preserved milk can take the place of fresh milk. The law of natural desire for food is the only law as to frequency, but unfortunately even infants early come to have substitutes for instinct and the cry is not always the criterion. Hence, we are to study such indications as have led good authorities to say that "infants should be fed at regular intervals, and if they vomit after taking milk they should be fed on smaller quantities given at shorter intervals." As a rule, for the first month the feeding should be every two hours, gradually increasing the interval to three, and at four months to four hours. After children begin to have teeth there is an indication for such solid food as stale bread and potatoes, with a little butter. Great evil is believed to come to children from the time of weaning, or even before, up to the time of three to six years of age, from the habit of feeding at the family table, and of supplying them with all the varieties of food furnished. The English custom is wholly different from this, and even if it were not, the variety on the table is far less.

A careful medical observer, who has studied the young population of tenement-houses, claims that children suffer far more from these mixed foods than from poor milk. Children who drink much water are very apt to be affected thereby. Water that has been boiled and then cooled and poured from one pitcher to another, so as to have more air through it, is much better for children than other drinks. Milk and cocoa are best if the design is to combine food and drink. In cities or other localities, where there is any doubt as to the purity of water, children should always have water which has been boiled.

The effect of foul air on children is never to be lost sight of. Their very littleness brings them into the closest range of atmosphere, and they are often weakly because supplied with foul air. We are convinced that those who have the care of children can very much diminish infant mortality by attention to the food and the air-supply for children. Valuable articles in former reports have given directions as to artificial foods, as well as shown how imperfect many of

them are. If only the well-known principles as to foods and drinks and their uses for children were applied, the serious death-rate among them could be much diminished.

SPECIAL DISEASES.

The study and comparison of the various special diseases which cause death are even more important than any statement of aggregate numbers.

In some cases where the disease is local and belongs to that division which has been characteristically termed "Filth Diseases," we are pointed directly to local causes of disease and death. Even where the individual has good surroundings, we also often trace out the foul locality, or the special contamination or exposure by which the earlier cases were caused and from which they received their epidemic momentum and activity.

In other cases, such as that of measles and some other of the eruptive diseases, we are able to account for the fatality by the extreme dampness of the season, or of the locality, or at least to study the effects of climatological conditions.

The year has been a remarkable one in the prevalence of several of the more communicable diseases. As to measles, we doubt whether, in any one year, there has ever before been such a wide-spread seizure. It was epidemic in every county of the State, except Salem county, and in almost every portion of every county. Some of the cities showed a large mortality therefrom. Scarlet fever and diphtheria have largely prevailed. In fact, although the deaths from communicable diseases have been numerous, we are led to believe that the number of seizures has been in still larger proportions than heretofore to the number of deaths. The cases have illustrated, as never before, the value of Boards of Health and of sanitary inspectors, who at once put in operation methods of strict isolation as well as give attention to sanitary conditions and surroundings. We could mention localities in which this prompt method of procedure has caused a very limited epidemic, while in other places the neglect has added scores to the number of cases and to the number of deaths. There was a time when an outbreak even of the eruptive diseases was often, by the little natural communication had with other places, confined to narrow limits. But now, in New Jersey, at least, the railroad

goes almost everywhere. The people are constantly passing from place to place. Reliance upon the old methods will not avail. We are sure to have epidemics, from time to time, far more destructive than formerly, unless we anticipate these conditions and provide to prevent such universal spread.

We have been fortunate that, although cholera appeared at the New York quarantine under threatening circumstances, it did not get foothold in the country. Some revelations, however, made as to our dependence as a State upon the methods in use at that quarantine, emphasize the importance of some more exact local care in our own behalf. It would be well if each ship arriving at the various docks in Hudson county, were critically examined on arrival, and if all the points at which customs are collected were more rigidly guarded.

REMITTENT FEVER.

The total of deaths from this cause for the official year is 217, instead of 243 for the year ending June 30th, 1886, and 209 for the year ending June 30th, 1885. The chief excess is in Hudson county, which has 63 deaths from this cause. Cape May county is the only one not recording a single death. There is considerable variation in the counties when studied over a series of years. This mortality, with all the varied forms of malaria, chills and fever and intermittent neuralgias which occur at the same time, continues to point to local causes of the disease. While discussions will continue as to what may be the specific cause of this class of diseases, the places in which its activity is manifested are those where heat and moisture and the exposure of great quantities of vegetable organic matter to forced, excessive or unnatural decomposition cause deterioration or pollution of the air. Thorough drainage, the unobstructed flow of water-courses, where there cannot be dams without overflow or damage, and such culture as will utilize the products of decay, are still our most available preventives. It is now well recognized that in many cases it is not so easy as formerly to draw the line between fevers dependent on marsh miasm or vegetable decomposition and such as are modified by the accumulation of population.

Hence, we have the term Typho-Malarial, as also the admission that other fevers are modified in their type by heaps of filth, by cess-pools or by other surroundings.

Our laws are now very favorable to the carrying out of local or general drainage plans. There are portions of the State greatly in need of a liberal policy in this behalf. Physicians can aid much in popular sentiment as to these matters and in thus securing greater health for the people.

TYPHOID FEVER.

The aggregate deaths from this cause for the year number 522, as against 545 for the previous year, and 642 for the year ending June 30th, 1885. It is considerably below the general average for the past nine years. The causes of the disease are better understood, and where sanitary administration is good there is diminution of its frequency.

The epidemics at Mount Holly and at Toms River were quite extensive.

There is no disease that is more fully recognized as preventable. Yet it is a form of fever that is sure to occur wherever there are close populations, unless there is a correct and efficient system of sanitary administration. Our experience during the past year shows how frequent is its occurrence and how thoroughly the attention of all Local Boards needs to be directed to its prevention. While it is chiefly through the medium of water-supply and by contamination thereof by the excreta that the disease is propagated, it is not tenable that this is the only possible mode of conveyance. Prof. Brouardel, of Paris, in his recent able paper before the Sixth International Congress of Hygiene, at Vienna, says: "I am not prepared to say that typhoid can never arise merely from foul air. In a family of nine living on identically the same food a son alone contracted typhoid fever. It was found that under his room window there was an open soil-pipe. In another family precisely the same incident occurred, and this among my own patients and quite recently. Nevertheless, water is the more general cause of the disease."

It is also true that there is some confusion as to the character of some fevers that have distinctly typhoid symptoms. So, some are disposed to entertain views as to modifications of type and even of lesions, and speak of adynamic, cesspool and mongrel fevers. But the imperative lesson is to run no risk with water-supplies, to take the most exact and prompt care of all excreta and to secure the most perfect sanitary conditions possible.

SMALL-POX.

Five deaths are reported for the past year as against four of the previous year. There have been many more cases in the State, but fewer were fatal and the disease was not permitted to extend. We have had no large mortality since 1881–2, when 367 deaths occurred from this cause. Prompt vaccination has prevented epidemic extension.

We have in another connection noted some lessons we are being taught as to the details of vaccination and the need of re-vaccination. But every new investigation confirms the sovereign value of this preventive when used with skill and when repeated according to indications.

SCARLET FEVER.

The deaths from scarlet fever for the past official year, were 255, which, although 33 more than the former year, was not over one-half the average for the last eight years. We believe more careful isolation and details of cleanliness have much to do with this diminution. At our last writing some light was apparently being thrown upon the origin of this disease. Power and Klein, two observers for the Local Government Board of Great Britain, seemed to have shown that it was a disease that sometimes occurred in the bovine species, and was transmitted from this source. Professors Brown and Crookshanks have since conducted similar examinations, and contend that the disease is cow-pox and not scarlatina. It is probable that further examinations will settle the vexed question. Dr. McVail, of England, and some others, have claimed that the excretions of scarlet fever patients are to be dealt with like those from typhoid fever, as they seem in some instances to have been the conveyancers of the disease. So serious and extensive are the ravages of this disease, that every effort for isolation should be used, and malignancy prevented or counteracted by all the details of enforced cleanliness. Parents should be cautioned not to send their children to school when having any form of sore throat, or any sudden eruption, unless some physician asserts the non-specific character. There should always be an understanding between Local Boards and School Trustees, so that children from families or houses in which there is contagious disease should not be allowed to attend, unless duly authorized.

MEASLES.

We have already alluded to the prevalence of this disease in the State for the past year. The great increase of death-rate records the result. The deaths were 296, against a record of 88 deaths in 1885–6; 135 for 1884–5; 187 for 1883–4, and an average of 115 for the five years previous thereto.

It was frequently noted that the type of the affection was unusually severe. Not a few deaths occurred from bronchial and pneumonic complications after the danger seemed past.

The contagion was in some cases so active that good observers claim that in one case a second attack occurred within a month, and that in another case it was coincident with varicella. A few cases of recurrence after long intervals are also noticed. It is, however, very rare that any of the eruptive diseases occur a second time. While the fatality from measles in proportion to the number attacked, seldom or never reaches in this country the degree reached in Great Britain, it is nevertheless an affection which too often leaves the pulmonary tissue susceptible to the inroads of consumption or bronchitis.

WHOOPING-COUGH.

Whooping-cough records 181 deaths. This is below the number in 1885–6 (274), and just the same as that for 1884–5. It was considerably above the general average, and shows relation to weather, localities and exposure. While not a deadly disease, its protracted nature and the violence of the attack often result in brain or pulmonary diseases. As a result not a few die from convulsions, or capillary bronchitis. The view is confirmed that the dried sputa from this disease may be the medium of contagion. It is a disease the severity of which is much modified by the avoidance of undue exposure, and by the use of medicines which control nervous systems and mitigate the severity of the cough.

DIPHTHERIA AND CROUP.

This continues to be the most devastating enemy to child-life. The fact that one attack does not protect from another, and that not infrequently adults are attacked, makes it all the more formidable. Both

clinicians and pathologists are giving to its study the most careful attention.

One thousand five hundred and twenty-seven deaths are reported from this cause. The record of 1885–6 was 1,303; for 1884–5, 1,496; for 1883–4, 1,027, or for the five years ending June 30th, 1883, 1,144. The fatality is beyond that of any one year, the nearest approach thereto being in 1881–2, with its record of 1,472 deaths.

It has long been a question what are the precise relations of membraneous croup to that form of diphtheria which now occurs as apparently a specific disease. Very many good authorities regard them as manifestations of one and the same disease. In many cases the symptoms are so identical that distinction cannot be made even in a secondary way. Prof. Virchow has endeavored to outline the difference between the tracheal membrane of croup and the membrane of diphtheria. He calls the former a fibrinous membrane on the surface of the trachea, and the latter a necrotic surface, which, when separating, does so, not by a process of exfoliation but by ulceration. He claims that the false membrane of croup can be separated like a cast, without leaving a raw surface. Where the membrane of croup penetrates the lung it is a croupous process, while that of diphtheria is a necrotic layer penetrating the tissues. Yet he admits that where the diphtheritic process is superficial it is attended with fibrinous exudation, so that where it is thus superficial the two processes are identical. This necrotic tendency he attribntes to the presence of small granules, which he regards as parasitic organisms, although he formerly regarded them as exudation granules. It is in these that the infection resides and from these it acquires its specific character. These distinctions are not as yet authenticated, but if real there is no difference in the initial exudation. The important question is under what circumstances the process becomes necrotic. If parasitic, it is all the more evident that treatment should very early be directed to local as well as to constitutional conditions. It can confidently be said that the great danger from diphtheria is from the insidious nature of the attack—the concentration of the poison. All experienced physicians now know that if they can grapple with a case at the very first manifestation of the disease they are likely to be successful. Too often, there is a large patch in the throat and the constitution has become involved from the local effect before there is treatment. It is possible both to put on the throat and into the blood medicines which

interfere with the infective and destructive processes. Every physician is aware of instances where failure to isolate and concentration of the poison have caused direful results. A case occurred to us thus: a servant fourteen years of age, employed in a family where a fatal case of diphtheria had occurred, had a small deposit on the tonsil. She insisted on going to her home, some two or three miles distant. There had been no diphtheria in that neighborhood. It was very cold weather, and the father, mother and four other children all occupied, by day and night, one close room. Within seven days all but the father and the mother were dead of the disease. No other case occurred in that section. Our great power over the disease is in the use of disinfectants and in early preventive and isolating methods. With these thoroughly followed out, the number of cases of death therefrom in the State could be reduced to a very small proportion of the present loss. Where an outbreak occurs in a family before isolation could be secured, so long ago as 1877, the Secretary of this Board advocated the prophylactic use of potassium chloride and iron and quinine, as also a daily examination of the throats of the other children before seeing the sick one. While these views, often since presented, have led to some valuable results, they have not met with general adoption. A recent debate before the New York Academy of Medicine has helped to show that in this and some other diseases individual prophylaxis will yet come to be regarded as one of the most efficient methods of preventing the spread and fatality of the disease.

ERYSIPELAS.

Erysipelas is charged with 96 deaths, which is below the record of last year (111), but not below the general average. While many forms of erythema or other eruptions or surface congestions are sometimes spoken of as erysipelatous, there is no doubt that true erysipelas is a specific and communicable disease. It is at once to be met as such. All the more caution is needed because of its strange tendency to seize upon parturient women and to show itself in the form of puerperal fever. Physicians attending cases of erysipelas have come to recognize this risk. A recent case in Vienna illustrated the opposite infection.

Dr. Pritzil, the chief assistant of Prof. Braun's Clinic, acquired infection from a patient with puerperal fever, and erysipelas of the face

ensued, which proved fatal. Besides the cases returned as erysipelas, some of the non-traumatic deaths returned as from pyæmia or septicæmia are no doubt the results of the same specific poison.

DIARRHŒAL DISEASES.

Two thousand six hundred and ninety-four deaths is the record of this cause of mortality among the younger population. The mortality for 1885–6 is recorded as 2,664; the number 1,938 occurring in cities shows how much more operative are local than constitutional causes. Under this head fall all deaths from diseases of the digestive apparatus from one month to 20 years. Not a few of those occurring under one month are returned as diarrhœal, but developmental and hereditary influences so largely predominate as to make it proper not to include these, and so we do not. Improper food, impure water, exposures to extreme heat and to sudden changes of temperature and humidity are mostly the exciting causes of these affections. The use of artificial foods and the tendency to rear children without the maternal milk, add much to the mortality. Where artificial foods are necessary great attention should be given to their choice. While the well-advertised claims of scores of preparations may easily confuse some, chemistry and medical investigation and experience have quite clearly designated the choices to be made.

CONSUMPTION.

Three thousand six hundred and fifty-three deaths from this cause is the record of the past year. While we are to remember the increase of population, and especially in cities, there is more than a corresponding increase in this special malady. In the last nine years, 28,470 persons have died of this one disease. The number the previous year was 3,205. It is not surprising that lung diseases in general, and consumption in particular, make a large record amid the causes of death. Besides the unquestionable influence of heredity, the increase of indoor industries, many of them providing, in addition, irritating dusts, and the crowding of our people into cities, cannot but add to this form of disease. The knowledge of any family tendency or the want of vigorous development, far oftener than it does, should influence or control the decision as to place of residence or the vocation to

be chosen. The possibilities of prevention are far more significant than the records of cure. The very fact that tubercles are most frequently found in that portion of the lungs the least penetrated by air, and in persons who show the least of physical vigor, evidently point us to the need of full respiration and increased muscular and general bodily activity.

It will yet come to be understood that no influx of foreign population can substitute the need for a strong, healthy, home-reared race. In the absence of the military methods so common in the old world, we need, in our systems of instruction, to give full consideration to physical education. While the industrial school can aid in this, there must also be the recognition of physical training and culture as an absolute necessity if we would secure a vigorous population. So much of the future physical and productive life depends upon physical habits and vigor acquired in the first fifteen years, that it behooves us especially to see to it that such lung power is secured as will make this the means of aiding in the upbuilding of the entire physical frame-work. In the former report we illustrated the effects of one industry on consumption. The facts stated in the report this year as to some diseases of potters, furnish another illustration in the same direction.

ACUTE LUNG DISEASES.

Pneumonia, bronchitis and other forms of lung or pleuritic affections destroyed 2,557 lives the past official year. The record of 1885–6 was 2,300 and of 1884–5, 2,566.

While cold is a tonic, in a variable climate such as ours, and in the very diverse relations of locality to woods, to sea-shore, to rivers and lakes and to sand plains and to high altitudes, much attention needs to be given, either to the avoidance of exposure to sudden changes or to such food, clothing and management as will adjust us to changing conditions. It can be said of very many attacks of acute lung disease that, had there not been some ignorance, carelessness or imprudence, the seizure might have been avoided and the life preserved. For not only the weak are thus attacked, but frequently the most hardy or robust. Those are especially liable who, having become unconsciously depressed by the close air of the factory or the home, are suddenly exposed either to severe cold or great humidity.

The power of resistance afforded by good clothing, and still more by the good natural heat which food and exercise afford, is never to be lost sight of.

BRAIN AND NERVOUS DISEASES OF CHILDREN.

The record of 1,886 deaths from this cause as against 1,774 and 1,791 in the two previous years is not an increase more than in proportion to the increase of population, yet it is a large destruction of child-life.

The greater number of these occurring in the cities than in the country is especially noticeable. There is nothing more appalling in our modern civilization than the fearful increase in disturbances of the brain and of the nervous system. Whether exhibited by direct derangement or imperfect mental vigor or in all the protean forms of nervous invalidity, it betokens radical disturbance of vital parts, such as unfits for the stern struggle in life or entails imperfect vigor of will and self-control upon offspring.

There is no class of diseases that more needs to be studied with a view to their prevention, since they are so often the result of errors in food and sleep and regulated activity in which the home and the school-room are large factors.

DISEASES OF THE HEART AND CIRCULATION.

The record of 1,530 is quite uniform with that of the three previous years, but an increase over the average of our first quinquennial period.

It is much more difficult than formerly to lead a quiet and peaceable life. While diseases of the heart and circulation are not so common from acute diseases as formerly, cases from overstrain, fatigue, nervous excitement and unrest are more frequent. While the medical art succeeds often in prolonging the lives of those who have some serious impairment of the organs of circulation, it is seldom that full compensation for an organic lesion is secured. Even some of the modern gymnastics and the violent open-air games have been injurious in their effects on the heart and its connecting vessels. Tobacco undoubtedly disturbs heart action to a hazardous degree in many habitual smokers. Any impairment of a vital organ is so much a limitation upon the activities of life, that all the causes lead-

ing to profound disturbance of circulation need to be avoided. The use of alcoholic drinks has record here as well as in diseases of the digestive organs.

RENAL AND URINARY DISEASES.

Eight hundred and seventy-three deaths are recorded from these causes. This is a little below the average for the last three years, but higher than the general average. It is a class of diseases not hereditary and nearly all artificial. An examination of ages will show that they occur in the active period of life and shorten many a valuable life.

The minute capillary circulation of the kidneys and the important functions they perform in separating effete materials from the blood, make the preservation of their entire capacity of the utmost importance. The amount of solids eliminated with the urine is equal to the separated material voided by the alimentary canal. Alcohol and various other irritating substances aid in producing these congestions, which, too often, give rise to local inflammations, suspending important functions. There are no blood purifiers to compare with the liver and the kidneys, and if allowed to do their natural work they are equal to the cleansing. It is chiefly because of abuses beginning in our improper use of drinks and of foods that they so often fail.

ADULT BRAIN AND SPINAL DISEASES.

The returns for this year show 1,966, the record for the former year being 1,932. The constant and almost uniform increase in this class of diseases points to some broadly-operating cause.

While so many perish in early life from some form of affection of the nervous system, about an equal number die after twenty years of age of the various affections classed under this head. They are often the index of the accumulated results arising from overstrain or from a neglect of the natural laws of health.

The severest forms are represented in the records of asylums and in the increasing number of their inmates, but these make only a small proportion of those who, by some form of paralysis, or by headaches, nervous prostration and general nervous incapacity, are restricted in the full and effective use of labor and of life.

ADULT DIGESTIVE AND INTESTINAL DISEASES.

The returns for the year record 1,242 deaths from these diseases. The previous year gave us a return of 1,213, which was a decided increase on former years. A large number of these deaths, as the result of errors in food and life, might be classed as preventable.

If only the people would avail themselves of the great increase of knowledge as to foods and the laws of their digestion, there ought to be a large diminution of this class of diseases. In no department of medical study has there been more advance than in Dietetics, and what may be called the Therapeutic uses of food. Nourishment can be secured, and yet one part of the digestive apparatus rested while the other is employed. Debilitated organs have thus the opportunity for recuperation. Even foods and liquids can be chosen that are so nearly digested as to be quite ready for absorption. While the range of natural foods is large, it is often of importance to be able to vary supply according to the ability of the various organs occupied in the digestive process.

CANCER.

Five hundred and seventy-four deaths are returned from this cause, as against a record of 546 for the former year.

The various forms which cancer assumes, and in some cases the difficulty of diagnosis, cause some variation in the record of this disease. Yet, a comparison of statistics, both here and abroad, seems to indicate an increase of this malignant ailment. It seems quite probable that abnormal growths, at first benign in their character, may, by peculiar failures of the system, or by local irritations, take on a malignant type. Whenever any skin-irritation or any form of abnormal growth occurs, there is a natural tendency to deal with it. The first attention is very often unskillful. It is always well to remember that wrong treatment is worse than no treatment at all, and to seek, if need be, only skilled advice. Many good authorities regard it as at first of local origin. The *Lancet* thus comments on a recent lecture by Virchow:

"Virchow evidently attaches no importance to the reported discovery of a cancer bacillus, nor does he think that the discovery of a cancer micro-organism is necessary to explain the known facts of the disease.

He is strongly in favor of its local origin, and, firm in this belief, he entertains the hope that some means will yet be found of eradicating the disease in its early stage, when it is purely local. Whether this is to be by surgical interference or by the action of some drug he is not prepared to say; but he sees nothing in the nature of malignant tumors in their early stage to render them impossible of cure by the art of the physician, and he urges surgeons not to be too sceptical of the possibility of curing cancer by drugs."

ACUTE RHEUMATISM.

The record of 132 deaths from this cause is a somewhat surprising number, since the previous average has been but about sixty. Our record as to it is somewhat embarrassed by the fact that certificates do not always record the relations between it and acute pericarditis. As it tends to attack all fibrous and ligamentous tissue, as well as to invade joints and heart structure, it always, in its acute forms, needs prompt treatment. The forms of ache, myalgia, neuralgia and stiffness of muscles, usually massed under the name of chronic rheumatism, need more attention. They betoken some form of malnutrition or degeneration of tissue, and, besides the discomfort, result in much curtailment of working power. Generally they call for active treatment, as well as for such habits of rest, exercise and clothing as will aid in heat and force-production.

PUERPERAL DISEASES.

Two hundred and sixty-three deaths occurred from these, while the record for the previous year was 257, both of which are a little above our general average. We include under this head all deaths of women in child-bed or from non-malignant diseases directly connected with the reproductive system. Of these the most serious and fatal is puerperal fever. There is no such disease as autogenetic puerperal fever. The infection is from without. It has strange relations to scarlet fever, erysipelas, &c., besides its probable occurrence as a result of surrounding conditions. It is no longer doubted that it is conveyed by nurses or by careless physicians. (See article on "Antiseptic Obstetrics," *Philadelphia Medical News*, March 5th, 1887.) Let us, then, look upon puerperal fever as one of the preventable diseases, and see to it that the precious lives of mothers are not sacrificed by careless

and insanitary management. No causes of death are sadder, since often these losses mean the orphanage of children and the cutting off of useful lives in early or middle life. Antiseptics are more freely used in order to guard against the introduction of the disease from without. But to these must be added all the most scrupulous details of excellent sanitary management.

ACCIDENTS.

The returns of deaths by accident are 1,051. There is a steady increase of these. The various forms of accident deserve the careful attention of all who seek to guard human life from unnecessary risks. Most accidents are the results of ignorance, unskillfulness or carelessness. The coroner's jury wisely inquires into details, but does not frequently enough trace out all the facts. These deaths are generally of those who give promise of long life, and not unfrequently of those whose exposures are due to special physical vigor, activity or courage.

We draw the attention of all, and especially of physicians, to a careful review of the facts which our statistics reveal, as also to the great opportunities now afforded for the study of methods of preventing disease as well as of treating it. Each year more and more furnishes the evidence that the true physician is diligent not only in alleviating human disease and suffering but in seeking to prevent it. Thus he adds to a high vocation the highest privilege of the citizen and of the philanthropist and does what he can to benefit his fellow-man.

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NOTE.—All Boards will please give attention to the Vital Statistics Law as explained, pages 301 and 302, and all but Township Boards, to the Plumbing Law, page 231, which goes into operation July 4th, 1888. Specimen regulations will be printed previously.

N. B.—On page 6, lines 12 and 13, reckoned on American proportions, read for "20,000," twenty million weeks, and for "$100,000," one hundred million.

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